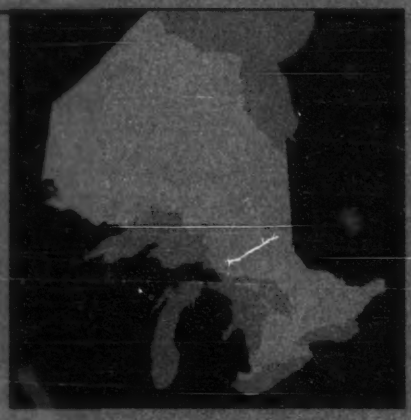
Ontario

Ministry of Transportation

Materials Engineering and Research Office Report



# MTO Granular Aggregates Summary 2010

MERO-041

Ontario

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Materials Engineering and Research Office Report

# MTO Granular Aggregates Summary 2010

MERO-041

Technical Report Documentation Page

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|---|---|
| **Publication Title** | MTO Granular Aggregates Summary 2010 |
| **Author(s)** | John A. Blair, Darrin La Pointe, Stephen A. Senior |
| **Originating Office** | Soils and Aggregates Section, Materials Engineering and Research Office |
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**Abstract**

This report provides a summary of the quantities placed and the compliance of granular aggregates tested with MTO material specifications for the 2010 construction year. Each of the following granular aggregate types are summarized in this report: Granular A, Granular B Type I, Granular B Type II, Granular B Type III, Granular M, Granular O, and SSM.

The five Regional Quality Assurance Sections submitted data from contracts that were active during the 2010 construction season, and that data was summarized in a series of tables and graphs. Provincial and regional summaries are included for the quantities placed, the number of lots and quantities that were tested, as well as the number of lots and the quantities of material that were accepted at full price, accepted at a reduced price, and rejected.

During 2010, approximately 8.45 million-tonnes of granular materials were used in MTO's road construction contracts, of which a significant proportion, i.e. 13.1%, was produced from material excavated from within the right-of-way and 1.5% from reclaimed materials. Granular A represented 38.6% of the total granular materials placed by MTO.

About 3.58 million-tonnes, or 42.3% of the total granular aggregates that were placed, were tested to determine payment adjustments for quality assurance purposes during the 2010 construction season. Based on the total granular aggregates placed, the vast majority of that tonnage, i.e. 94.9%, was accepted at full price.

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Prepared by:
John A. Blair, Darrin La Pointe and Stephen A. Senior

Soils and Aggregates Section
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Highway Standards Branch
Ministry of Transportation

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# 1.0 - Executive Summary

Each year, the Ministry of Transportation of Ontario (MTO) uses large quantities of granular aggregates for road construction purposes. This report is intended to capture the available information on the quantities and quality of granular materials supplied for road base and subbase, backfill, and other purposes.

Data sheets summarizing the quantity and quality of granular aggregates used in contracts for road construction during the 2010 construction season were received by the Soils and Aggregates Section at MTO. Based on this, approximately 8.45 million tonnes of granular aggregates were placed, of which 70.7% came from commercial sources, 14.7% came from non-commercial sources, 13.1% were produced from rock that was obtained within the ROW, and 1.5 % came from reclaimed materials (i.e. RAP and RCM).

At MTO, granular materials are specified according to standard special provision (i.e. SSP) 110S13.

Granular A represented 38.6% of the total granular aggregates placed and Granular B (i.e. types I, II and III) represented 44.4%. Granular O, Granular M, and SSM made up the remaining 17.0% of the total used.

Based on the QA acceptance system that was in place during 2010, approximately 3.58 million tonnes, or 42.3% of the total granular aggregates that were placed, were tested for quality assurance purposes. Most of the tonnage, i.e. 87.6%, was accepted at full price, 12.4% was accepted with an adjusted price and 11 thousand tonnes were rejected. However, since only 42.3% of the materials placed were actually tested, 94.9% of the granular aggregates placed were accepted at full price and 5.1% placed with an adjusted price.

# 2.0 - Introduction

Each year, MTO uses large quantities of aggregates for the construction, rehabilitation, and maintenance of provincial highways. These aggregates are continuously sampled and tested to provide evidence that they meet the physical quality and gradation requirements that are identified by the specifications contained within the contract documents of each project. Specifications have been developed to ensure that the aggregates meet the engineering needs for the intended application and to establish administrative procedures for acceptance and payment to the contractor.

For MTO's purposes, granular aggregates may be defined as unbound aggregates which are used for a variety of road construction purposes. Within the Highway Standards Branch of MTO, the Soils and Aggregates Section is responsible for material and construction specifications for Granular A (used for base, gravel sheeting, shoulder and bedding and backfill to sewers, culverts, and other structures), Granular O (used as a permeable granular base), Granular B, Types I, II, and III (used for subbase and backfill), Granular M (used for shoulder maintenance), and SSM (for subgrade material).

This report summarizes the quantities involved and the quality assurance acceptance of the granular aggregates that were used in MTO contracts for road construction purposes during the 2010 construction season. The summaries are presented as a series of tables and graphs showing the tonnages placed and the proportions of those materials that were accepted at full price, accepted with an adjusted price, or were found to be rejectable. Although several tests are used for quality assurance purposes, only the results for gradation and percent crushed (i.e. for Granular A only) are presented here. The results of these tests have been found to vary the most and, as such, have generally been used as the basis for acceptance (and payment adjustments) of granular aggregate materials.

The main body of this report generally summarizes the data on a provincial basis with more detailed regional summaries presented in the Appendices.

# 3.0 - Background

MTO's acceptance of granular aggregates is based on test results performed on samples taken from individual lots of material. The gradation and other quality-related aspects of these materials, and the protocol for establishing the size of each of the lots and how they are accepted, is based on MTO's Standard Special Provision (i.e. SSP) 110S13 (MTO, 2007). However a revised version of SSP 110S13 (MTO, 2010) was created in 2010 which is now being included in some of the contracts. In either case, the SSP replaces the current version of the Ontario Provincial Standard Specification (OPSS) 1010 to meet MTO's specific requirements for Quality Assurance.

Prior to 2009, the quantities of granular aggregates placed, and the number of lots tested and accepted, were recorded in PDF format on ®Word-based Granular Summary Sheets. However, for each granular material, a separate form had to be filled out and then the data manually transferred into an ®Excel-based file in order to summarize it.

To avoid the tedious transfer of data, an ®Excel-based data-gathering template, entitled a "QA Granular Summary Sheet" was developed to replace the original ®Word-based form. These new Granular Summary Sheets capture quantity summaries, details of the lots tested, and the disposition of those lots (i.e. such as whether they were accepted at full price, reduced price, or rejected) for all granular materials used on the contract.

These new QA Granular Summary Sheets were given to the Contract Administrators at the beginning of each contract. At the end of the 2010 construction year, the completed templates were then submitted back to the Soils and Aggregates Section, through the appropriate Regional Quality Assurance Office. The Soils and Aggregates Section then used a new data collection and calculation system (i.e. global file) which was also developed to automatically analyze, summarize, and present the data.

This report summarizes the quantity and quality of the granular aggregates that were used by MTO in road construction contracts during the 2010 construction season based on templates that were completed and received by the Soils and Aggregates Section before March 2011. The summaries are presented as a series of tables and graphs showing the tonnages of the aggregates that were obtained from conventional sources (i.e. pits and quarries), aggregates processed from material obtained from within the Right-Of-Way (ROW), reclaimed materials that were used, as well as how each of the individual granular types met the acceptance criteria. For the most part, the main body of this report summarizes the data on a provincial basis, with more detailed regional summaries presented in Appendices.

# 4.0 - Quantity Summaries

During 2010, the Soils and Aggregates Section received completed QA Granular Summary Sheets from a total of 137 contracts. It should be noted that, based on information obtained elsewhere, this is likely to represent at least three-quarters of the actual quantities used by MTO.

Each Granular Summary Sheet included the quantities of each different granular aggregate that was used on each contract on the basis of the production obtained from commercial sources, non-commercial sources, or aggregates produced from rock materials obtained from within the ROW.

For Granular A, BI, BIII, and M, the summaries also included the quantities of Reclaimed Asphalt Pavement (RAP) and/or Reclaimed Concrete Material (RCM) that were used. Although MTO also allows other waste products such as blast furnace slag, nickel slag, glass, and ceramics to be used in these granular aggregates, there was no reported use of any of these materials during the 2010 construction season.

## 4.1 - Quantities of Granular Materials by Type in 2010

Table 1 and Figure 1 summarize the total quantities of granular aggregates by type that were placed in each MTO region across the province during the 2010 construction season.

**Table 1: Quantity Summary of Granular Aggregates Used by Each MTO Region in 2010**

| Granular Material | Kilotonnes | | | | | |
|---|---|---|---|---|---|---|
| | Regions | | | | | Provincial MTO Totals |
| | Central | Eastern | Northeastern | Northwestern | West | |
| Gran. A | 293 | 162 | 1758 | 565 | 489 | **3266** |
| Gran. BI | 275 | 0 | 1259 | 0 | 4 | **1538** |
| Gran. BII | 25 | 503 | 919 | 41 | 24 | **1513** |
| Gran. BIII | 0 | 4 | 323 | 85 | 288 | **700** |
| Gran. O | 0 | 183 | 0 | 0 | 0 | **183** |
| Gran. M | 0 | 0 | 12 | 0 | 0 | **12** |
| SSM | 0 | 559 | 679 | 0 | 0 | **1238** |
| Totals (# of Contracts) | **594 (17)** | **1410 (10)** | **4950 (79)** | **690 (17)** | **806 (14)** | **8450 (137)** |

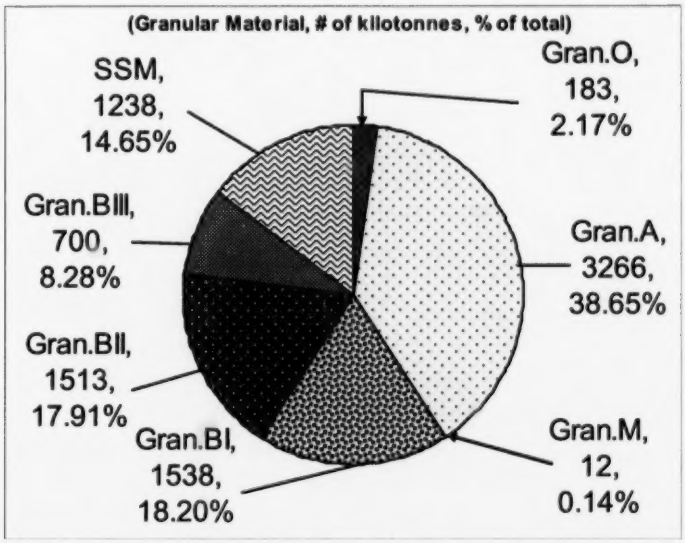



Figure 1: Total Quantities of Each Granular Aggregate Used by MTO in 2010

A total of 8.45 million-tonnes of granular aggregates were placed by MTO in 2010.

Granular A provided the largest quantity, i.e. 3.27 million-tonnes, or 38.7% of the total quantity of granular aggregates placed. This quantity includes materials coming from all possible sources, including commercial sources, non-commercial sources, aggregates produced from materials that were excavated from within the ROW, and reclaimed materials.

All three types of Granular B (Types I, II, and III) represented 3.75 million tonnes or 44.4% of the granular materials placed by MTO during 2010. SSM represented approximately 14.6% of the total granular aggregates placed (and only from Eastern and Northeastern Regions), and Granular O represented 2.2% of the total (resulting only from contracts in Eastern Region). Granular M represented 0.1% of the total granular aggregates and was used only in Northeastern Region.

Figure 2 shows the total quantities of all granular aggregates placed and the proportions used by each MTO region in 2010.

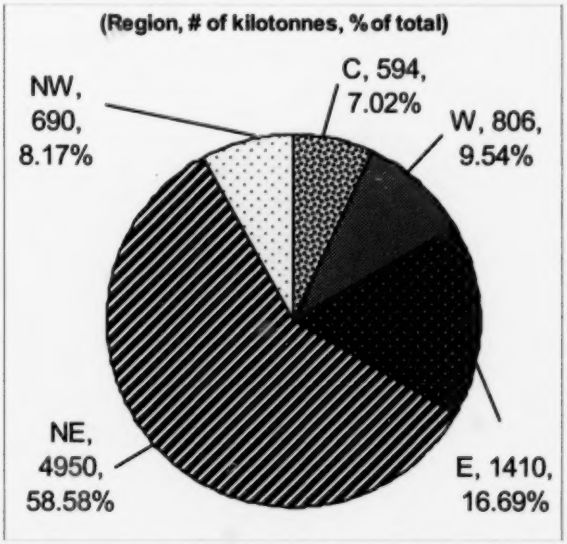
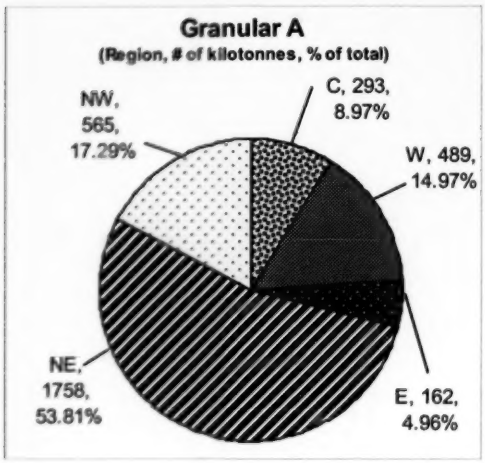


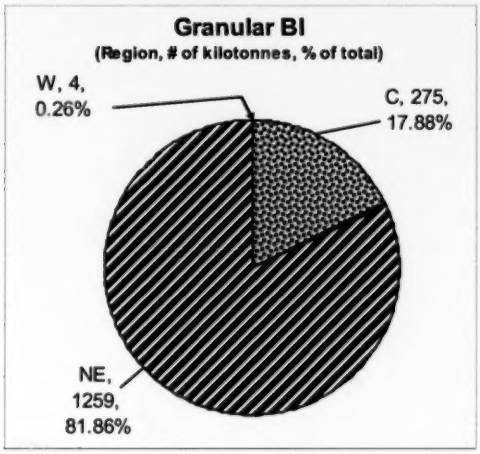

Figure 2: Total Quantities of Granular Aggregates Used by Each MTO Region in 2010

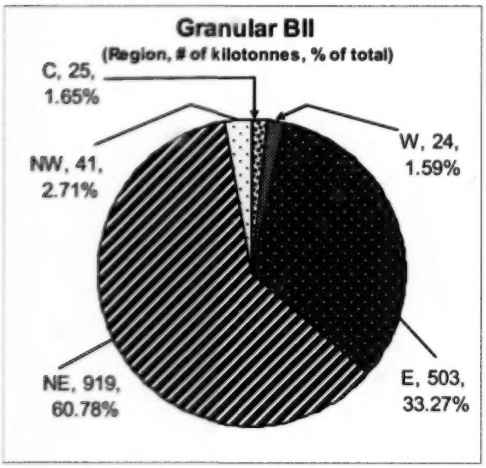
Northeastern Region used the largest quantity of granular aggregates (i.e. 4.95 million tonnes or 58.6%), followed by Eastern (16.7%), West (9.5%), Northwestern Region (8.2%) and Central (7.0%).

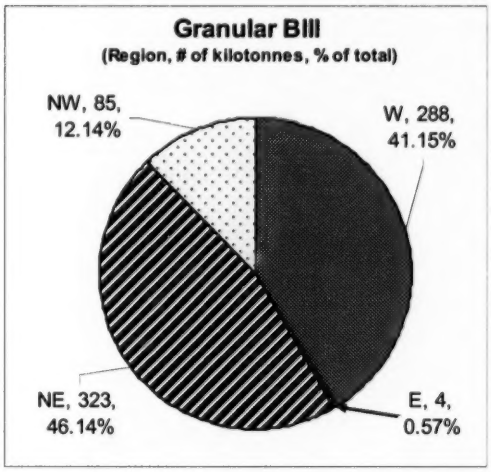
Figure 3 shows the quantities and the percentages of each different granular aggregate (excluding Granular M and O) that were used broken down on a regional basis. Granular A was used in all five MTO regions with Northeastern and Northwestern Regions placing 71.1% of the total. Granular BI was only used in Central, West and Northeastern Regions, with Northeastern Region placing 81.9% of the total or 1259 kilotonnes. Northeastern Region placed 60.8% or 919 kilotonnes of Granular BII and Eastern Region placed approximately 33.3% or 503 kilotonnes. The remainder was placed by the other three regions. Granular BIII was used in four regions with the largest quantities by far being placed in West Region (41.2%) and Northeastern Region (46.1%). SSM was only placed in Northeastern Region (54.9% or 679 kilotonnes) and Eastern Region (45.1% or 559 kilo tonnes).

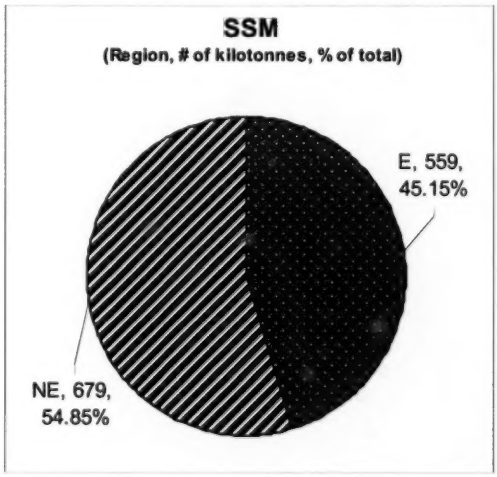
Figure 3: Quantities of Granular Aggregates Used by Each MTO Region in 2010



## 4.2 - Quantities by Material Source

Table 2 summarizes the total quantities of granular aggregates that were used in 2010 by each MTO region on the basis of source. These include commercial sources (i.e. licensed pits and quarries), non-commercial sources, aggregates produced from rock materials excavated from within the ROW, and reclaimed/recycled materials. Note that, in Ontario, non-commercial sources collectively refer to wayside sources, Crown sources, Letter of Approval sources, and Indian Land sources, as defined under the Aggregate Resources Act.

The detailed breakdown of these quantities by region and granular aggregate type are summarized in Appendix A. For the purposes of this report, natural aggregates include aggregates excavated from pits or produced from blasted rock in quarries or produced from within the right-of-way.

**Table 2: Quantities of Natural Aggregates and Recycled Materials Used in Granular Aggregates by Each MTO Region in 2010 by Source**

| | Kilotonnes | | | | | | % | |
|---|---|---|---|---|---|---|---|---|
| | Region | | | | | Province | Natural Aggregates or Recycled Materials | Total Granular Aggregates |
| Source | C | W | E | NE | NW | Total | | |
| Commercial Source | 537 | 696 | 1326 | 3222 | 194 | 5975 | 71.8 | 70.7 |
| Non-commercial Source | 41 | 0 | 0 | 727 | 476 | 1244 | 14.9 | 14.7 |
| Material from Right-of Way | 0 | 65 | 85 | 956 | 0 | 1106 | 13.3 | 13.1 |
| Total Natural Aggregate | 578 | 761 | 1410 | 4905 | 670 | 8325 | 100.0 | 98.5 |
| RAP | 5 | 45 | 0 | 44 | 20 | 114 | 91.2 | 1.4 |
| RCM | 11 | 0 | 0 | 0 | 0 | 11 | 8.8 | 0.1 |
| Glass/Ceramics | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other Recycled/Reclaimed Materials | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Recycled/Reclaimed Materials | 15 | 45 | 0 | 44 | 20 | 125 | 100.0 | 1.5 |
| **TOTALS** | **594** | **806** | **1410** | **4950** | **690** | **8450** | | **100.0** |

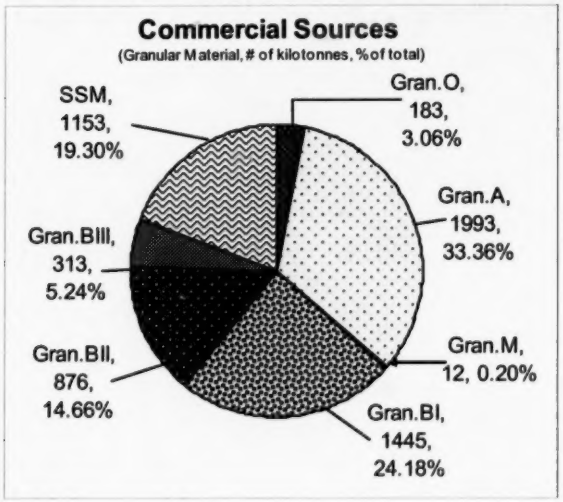
The majority of the granular aggregates used by MTO (98.5%) came from commercial sources. A proportion of the granular aggregates used (13.1%) were produced from rock excavated within the right-of-way. Granular aggregates produced from non-commercial sources represented 14.7% and RAP and RCM made up 1.5% of the granular aggregates used.

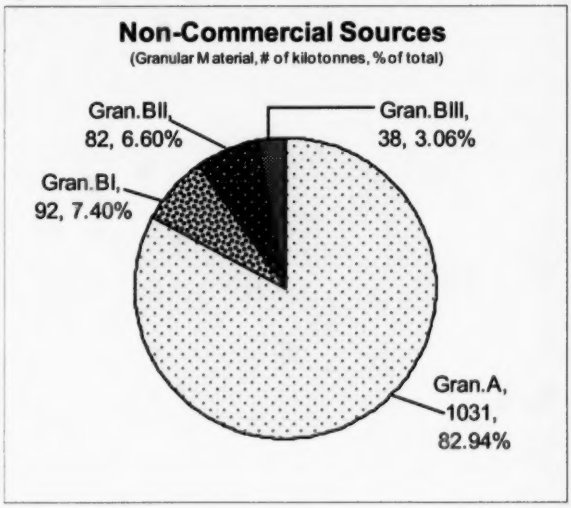
Figure 4 shows the tonnages and the proportions of each granular aggregate type that were obtained from commercial sources, non-commercial sources and from rock materials excavated from within the ROW.

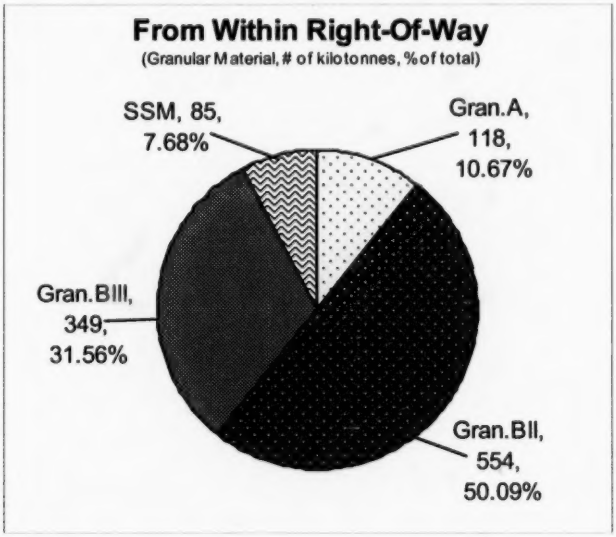
The aggregates used as Granular A, BII, or BIII came from all three of these sources. Granular O and

M were only produced from commercial sources. Bar charts showing the quantities of each granular aggregate type that were produced from each different source on a regional basis are also presented in Appendix B.

Figure 4: Total Quantities of Granular Aggregates Used by MTO in 2010 by Source




## 4.3 - Recycled/Reclaimed Materials

Although MTO's specifications allow blast furnace slag, nickel slag and glass and/or ceramics to be used in Granular A, BI, BII, and M, only Reclaimed Asphalt Pavement (RAP) and Recycled Concrete Material (RCM) were reported to be actually used in 2010.

Figure 5 shows that a total of 125 kilotonnes of reclaimed materials were used in granular aggregates in 2010, with RAP representing 91.2% of it and RCM 8.8%.

The total quantities and the proportions used by each MTO region are presented in Figure 6. West Region and Northeastern Regions used 71.2% or 89 kilotonnes of the total recycled/reclaimed materials in granular aggregates while the remaining three regions only used 35 kilotonnes of recycled/reclaimed construction materials.

It is recognized that full-depth reclamation (FDR) is a process that is used by MTO, which significantly reduces the need for granular aggregates. However, since FDR is done in-place, and the aggregates produced are not actually used in a particular granular aggregate type, it has not been dealt with in this report.

Figure 5:

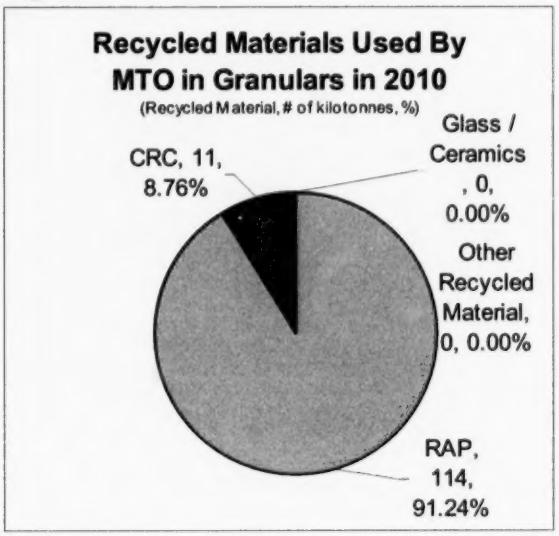
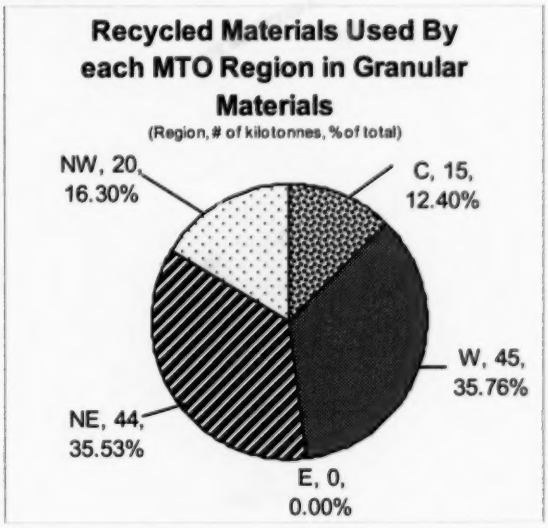

Recycled Materials Used By MTO in Granulars in 2010
(Recycled Material, # of kilotonnes, %)
CRC, 11, 8.76%
Glass / Ceramics , 0, 0.00%
Other Recycled Material, 0, 0.00%
RAP, 114, 91.24%

Figure 6:


Recycled Materials Used By each MTO Region in Granular Materials
(Region, # of kilotonnes, % of total)
NW, 20, 16.30%
C, 15, 12.40%
W, 45, 35.76%
NE, 44, 35.53%
E, 0, 0.00%

## 4.4 – Acceptance of Granular Aggregates

Granular aggregates used for road base and subbase materials are sampled after placement and prior to compaction. For contracts containing SSP 110S13 (August, 2007), such materials are tested and accepted on the basis of a lot system according to the following schedule:

i) One lot consisting of the first 5,000 tonnes delivered to the work;
ii) A 5,000 tonne lot selected from within the next 15,000 tonnes of delivered material;
iii) A 7,500 tonne lot selected from within the next 30,000 tonnes of delivered material; and.
iv) A 10,000 tonne lot selected from within each 50,000 tonnes of delivered material thereafter.

The lot schedule continues as presented above as long as the lots being tested are found to be acceptable. However, if at some point during the contract, a lot is not accepted at full price, then the lot schedule reverts back to 5,000 tonne lots and the lot sizes are only allowed to increase when two consecutive 5,000 tonne lots are accepted at full price. So the quantity of material within the lots being tested will almost always be less than the actual quantity being placed on a contract.

However, in 2010, a new lot system was developed to ensure that that the quantity of material being tested is the same as the quantity being placed. So a new version of SSP 110S13 (May, 2010) was created which may have been included in some of the 2010 contracts. In this new version, granular materials are tested and accepted on the basis of a lot system according to the following revised schedule:

i) For quantities of up to 5,000 tonnes delivered to the work (i.e. but sampling and tested may be waived for less than 1000 tonnes): One lot;
ii) For quantities of Granular A, O and M greater than 5000 tonnes delivered to the work: 5,000 tonne lots for the first 20,000 tonnes and 10,000 tonne lots thereafter;
iii) For quantities of Granular BI, BII, BIII and SSM greater than 5000 tonnes delivered to the work: 10,000 tonne lots for the first 20,000 tonnes and 20,000 tonne lots thereafter.

However, regardless of the lot system being used, each lot is divided into four equal sublots and a sample is randomly obtained from each sublot for testing. The mean and range of the percent passing for the four sublots on each sieve in a gradation test (and % crushed for Granular A only) forms the main basis for acceptance of the lot.

Physical property testing (such as micro-Deval and freeze-thaw) is also done for acceptance. However, since the material for these tests is accepted on a pass/fail basis, these tests are not used for production testing and, as such, were not dealt with in this report.

If the mean and range for gradation (and for Granular A, % crushed) within a tested lot is found to be acceptable, then all of the material within that lot is accepted and will be paid for at full price. However, if the granular aggregate does not meet these requirements, adjustment points are accrued and the lot that was tested is paid for at an adjusted (i.e. reduced) price. Depending upon the particular granular material involved, when adjustment points reach a specific value, the lot is rejectable.

Before the lot is given an adjusted price, the Contractor has the option of going to referee testing. The results of such testing are always binding on both parties. The results that the Soils and Aggregates Section have received include the results for any referee testing that may have been conducted.

Table 3 shows a summary of the total quantities of each different granular aggregate placed, the number of lots and the associated quantities that were tested in 2010, as well as the number of lots, the associated quantities, and the percentages of the totals that were accepted at full price, accepted with an adjusted price, or were rejected. The data is summarized on the basis of all of the QA Granular Summary Sheets that were received by the Soils and Aggregates Section. Detailed summaries for each of MTO's five regions are given in Appendices C and D.

**Table 3: Lot Summary and Disposition of Each Lot of Granular Aggregate Tested by MTO in 2010 (Quantities in kilotonnes)**

| | Granular Aggregate Type | | | | | | | Provincial Totals |
|---|---|---|---|---|---|---|---|---|
| | O | A | M | BI | BII | BIII | SSM | |
| Total Qty. Placed | 183 | 3266 | 12 | 1538 | 1513 | 700 | 1238 | **8450** |
| # of Lots Tested | 15 | 329 | 3 | 89 | 83 | 38 | 29 | **586** |
| Total Qty. Tested | 88 | 1829 | 12 | 711 | 510 | 216 | 210 | **3575** |
| (% placed) | (47.77) | (55.98) | (100.0) | (46.25) | (33.7) | (30.87) | (16.96) | **(42.31)** |
| # of Lots Accepted at Full Price | 9 | 265 | 3 | 85 | 78 | 34 | 27 | **501** |
| (% tested) | (60) | (80.55) | (100) | (95.51) | (93.98) | (89.47) | (93.10) | **(85.48)** |
| Qty. Within Tested Lots Accepted at Full Price | 50 | 1508 | 12 | 684 | 470 | 207 | 200 | **3130** |
| (% tested) | (57.14) | (82.47) | (100.0) | (96.13) | (92.17) | (95.88) | (95.24) | **(87.57)** |
| Qty. Actually Accepted at Full Price | 146 | 2956 | 12 | 1510 | 1473 | 691 | 1228 | **8016** |
| (% placed) | (79.53) | (90.51) | (100.0) | (98.21) | (97.36) | (98.73) | (99.19) | **(94.87)** |
| # of Lots Accepted at Adjusted Price | 6 | 60 | 0 | 4 | 5 | 4 | 2 | **81** |
| (% tested) | (40.0) | (18.25) | () | (4.49) | (6.02) | (10.53) | (6.90) | **(13.82)** |
| Qty. Within Tested Lots Accepted at an Adjusted Price | 38 | 310 | 0 | 28 | 40 | 9 | 10 | **434** |
| (% tested/% placed) | (42.86/ 20.47) | (16.95/ 9.49) | (/) | (3.87/ 1.79) | (7.83/ 2.64) | (4.12/ 1.27) | (4.76/ 0.81) | **(12.14/ 5.13)** |
| # of Lots Rejected | 0 | 4 | 0 | 0 | 0 | 0 | 0 | **4** |
| (% tested) | () | (1.22) | () | () | () | () | () | **(0.68)** |
| Qty. Rejected | 0 | 11 | 0 | 0 | 0 | 0 | 0 | **11** |
| (% tested) | () | (0.58) | () | () | () | () | () | **(0.30)** |

As Table 3 shows, a total of 586 lots representing approximately 3.58 million-tonnes of granular aggregates were tested on MTO contracts. This represents 42.3% of the total quantity that was placed.

Overall, 85.5% of the lots that were tested were accepted at full price. However, since 57.7% of the material that was placed was not tested and untested material is accepted at full price, 94.9% of the granular material that was placed was accepted at full price. The results also indicate that, on average, 13.8% of the tested lots were accepted with an adjusted price (5.1% based on the total quantity placed) and only 4 lots of Granular A were rejected. The quantity in the 4 rejected lots was not included in the total quantity placed.

All of the Granular M tested was accepted at full price. For the three types of Granular B, between 92.2% and 96.1% of the total quantity tested was accepted at full price (97.4% to 98.7% based on the total quantity placed). However, only 82.5% of the Granular A tested (90.5% of the total quantity placed) was accepted at full price. This represents a fairly significant amount (i.e. 310 kilotonnes) of price-adjusted material. Although a much smaller percentage of Granular O (i.e. 57.1% of the material tested) was accepted at full price than Granular A, only 183 kilotonnes of that material was actually placed and, as such, represented a small amount of price-adjusted material.

The details of each individual sieve where the adjustment points were accrued on a provincial basis are given in Tables 4 to 7 for all seven granular aggregate materials. All of these tables are based on weighted averages of the mean, range, and total payment adjustment factors.

For instance, in Table 4, the weighted averages for each sieve were determined by summing up the adjustment points accrued on that sieve multiplied by the tonnage tested for all contracts using the same granular material and then dividing that number by the total tonnage tested across the province. Table 5 represents similar data but it is weighted on the basis of the total tonnage placed. Figure 7 presents the data from these two tables in bar chart form and graphically shows the sieves where the payment adjustments were the most prevalent.

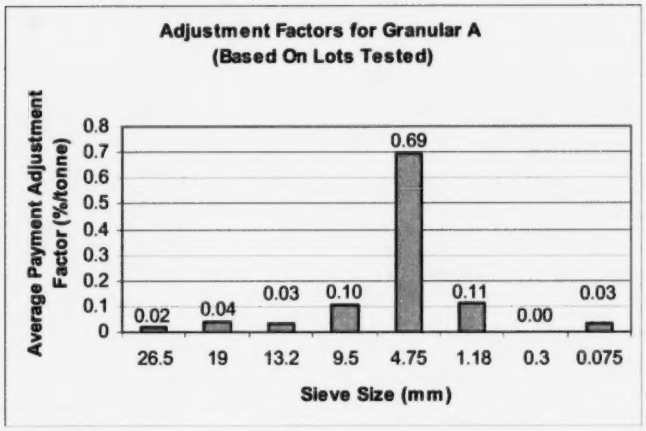
Tables 6, 7, and Appendix E are very similar to Tables 4, 5, and Figure 7, respectively, except that the weighted averages are based on the average payment adjustments in ¢/tonne. In this case, the weighted averages from Tables 4 and 5 are combined with the following prices for the various granular aggregate types:

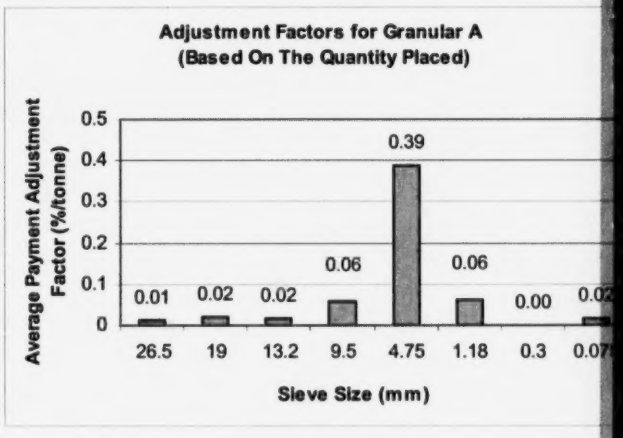
| | |
|---|---|
| Granular A, O, and M: | $14.00 per tonne; |
| Granular BII: | $12.00 per tonne; |
| Granular BI and BIII: | $10.00 per tonne; and |
| SSM: | $8.00 per tonne |

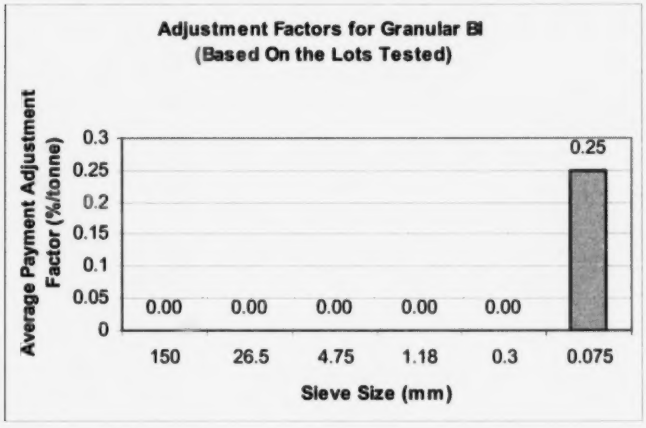
It should be noted, however, that the prices given above have been taken from SSP 110S13, May 2010 and may not necessarily reflect the actual prices paid for these aggregates for the granular materials used during the 2010 construction season.

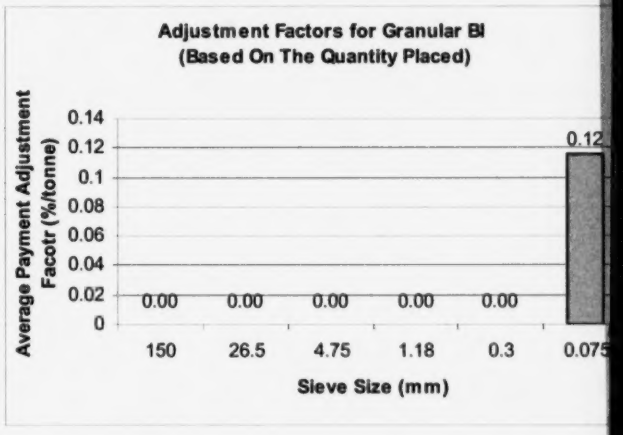
Based on the lots tested, the largest weighted average payment adjustment factor for Granular A was accrued on the 4.75 mm sieve (i.e. 0.69). For Granular BI, adjustment factors were only accrued on the 0.075 mm sieve. For Granular O, there were adjustment points accrued on the 19 mm, 13.2 mm and 9.5 mm sieve sizes, with the largest number of adjustment points being accrued on the 9.5 mm sieve. For Granular BIII, there was no payment adjustment factor required.

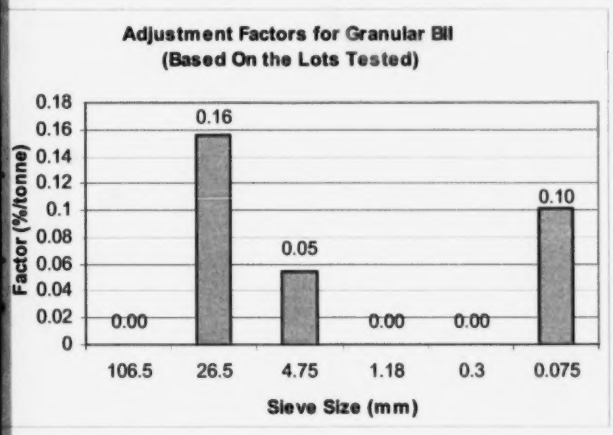
Figure 7: Weighted Average Payment Adjustment Factors for Granular Materials for all MTO Regions in 2010

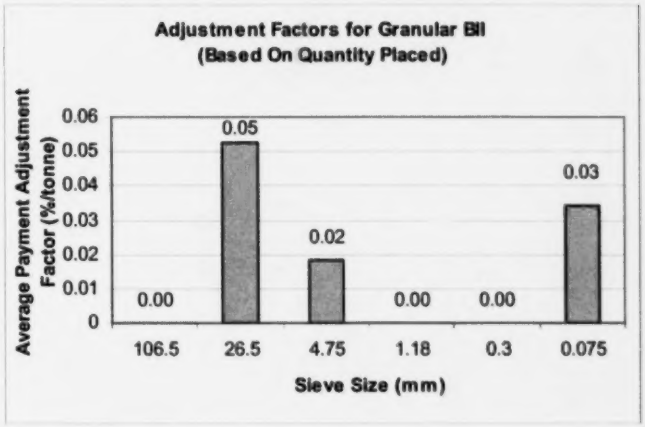


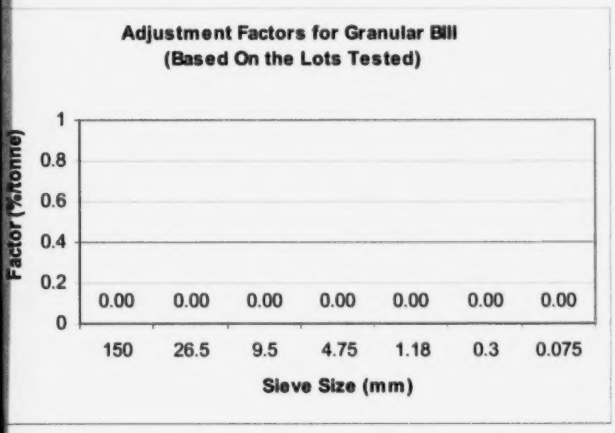



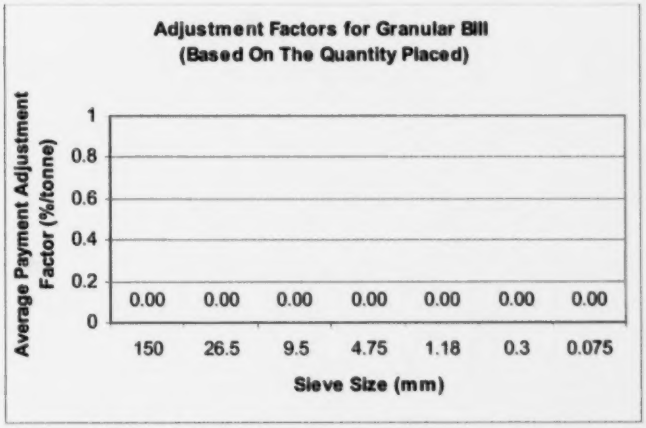



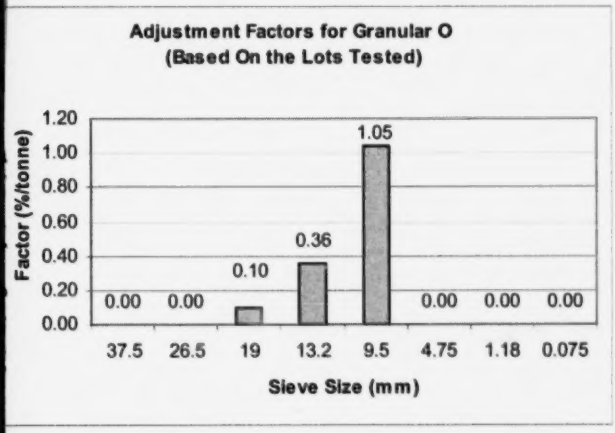



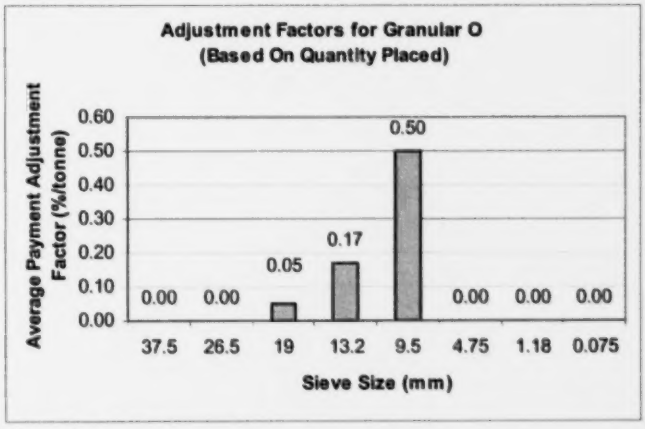

Adjustment Factors for Granular BII
(Based On the Lots Tested)
Factor (%/tonne)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.00
0.16
0.05
0.00
0.00
0.10
106.5
26.5
4.75
1.18
0.3
0.075
Sieve Size (mm)

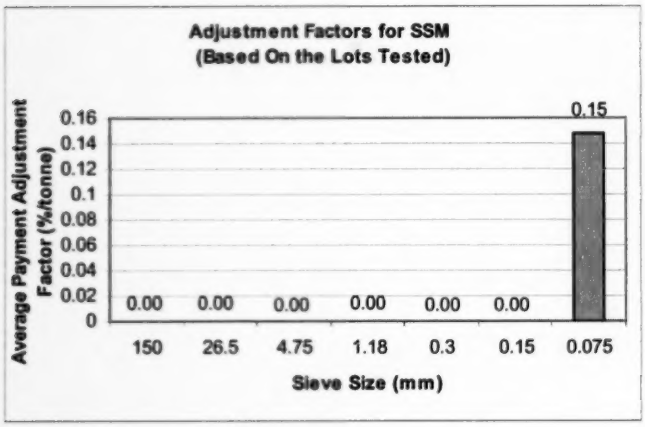

Adjustment Factors for Granular BII
(Based On Quantity Placed)
Average Payment Adjustment Factor (%/tonne)
0.06
0.05
0.04
0.03
0.02
0.01
0
0.00
0.05
0.02
0.00
0.00
0.03
106.5
26.5
4.75
1.18
0.3
0.075
Sieve Size (mm)

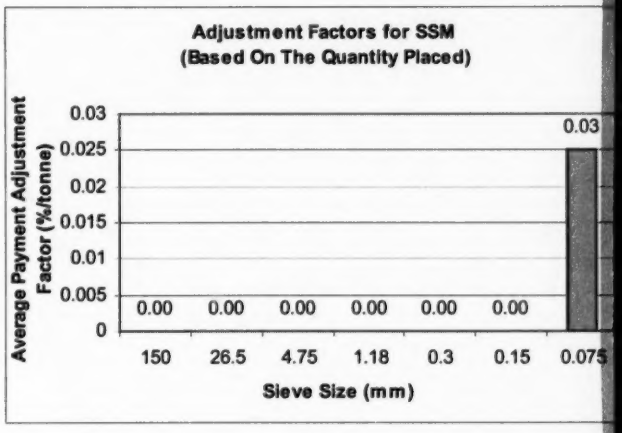

Adjustment Factors for Granular BIII
(Based On the Lots Tested)
Factor (%/tonne)
1
0.8
0.6
0.4
0.2
0
0.00
0.00
0.00
0.00
0.00
0.00
0.00
150
26.5
9.5
4.75
1.18
0.3
0.075
Sieve Size (mm)

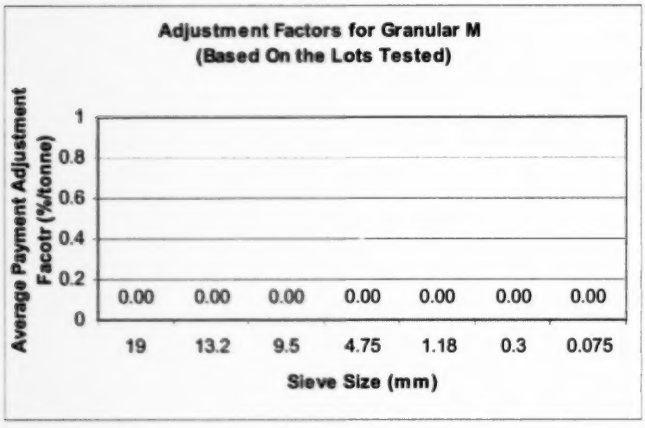

Adjustment Factors for Granular BIII
(Based On The Quantity Placed)
Average Payment Adjustment Factor (%/tonne)
1
0.8
0.6
0.4
0.2
0
0.00
0.00
0.00
0.00
0.00
0.00
0.00
150
26.5
9.5
4.75
1.18
0.3
0.075
Sieve Size (mm)

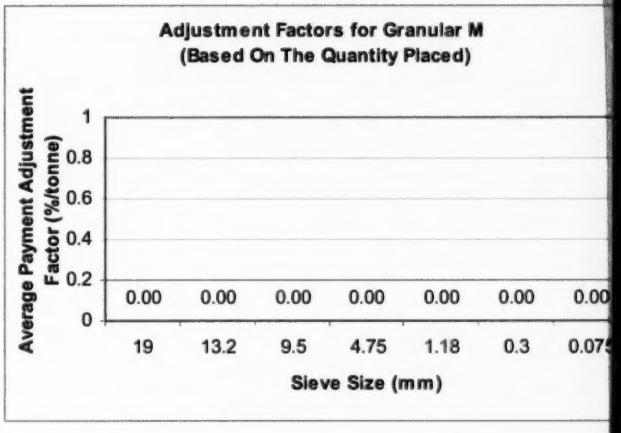

Adjustment Factors for Granular O
(Based On the Lots Tested)
Factor (%/tonne)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.00
0.10
0.36
1.05
0.00
0.00
0.00
37.5
26.5
19
13.2
9.5
4.75
1.18
0.075
Sieve Size (mm)


Adjustment Factors for Granular O
(Based On Quantity Placed)
Average Payment Adjustment Factor (%/tonne)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.00
0.05
0.17
0.50
0.00
0.00
0.00
37.5
26.5
19
13.2
9.5
4.75
1.18
0.075
Sieve Size (mm)




The overall average number of adjustment points being accrued on granular aggregates that were tested by MTO represents a total reduced immediate capital expenditure to the ministry of approximately $321,500 in 2010 based on the aggregate prices that were assumed in these analyses.

It should be noted that, since only 42.3% of the material placed was actually tested, the reduced immediate cost to MTO may have been significantly higher, assuming that the untested material is of similar quality to the tested material and that the relative cost to do the additional testing is also similar.

# 5.0 - Summary

Based on the 137 contract QA Granular Summary Sheets received by the Soils and Aggregates Section, the granular materials placed by MTO during the 2010 construction season can be summarized by the following:

1. A total of 8.45 million tonnes of granular aggregates were placed by MTO in 2010.
2. Of the total granular aggregates placed, the majority was placed in Northeastern and Eastern Regions (i.e. 58.6% and 16.7%, respectively).
3. Approximately 98.5%, or 8.33 million tonnes, of the granular aggregates placed were derived from natural sources (i.e. from pits or produced from crushed rock) while 1.5% came from RAP or RCM.
4. Of the 8.33 million tonnes of natural granular aggregates placed, 71.8% came from commercial sources, 14.9% came from within the ROW and the remainder (13.3%) came from non-commercial (i.e. unlicensed) sources.
5. Granular A and B (Types I, II, and III) represented 38.7% and 44.4%, respectively, of the total quantity of granular aggregates placed.
6. Almost all (i.e. 71.2%) of the recycled/reclaimed materials used by MTO in granular aggregates were placed in West and Northeastern Region.
7. Of the 8.45 million tonnes of granular aggregates placed, approximately 42.3% or 3.58 million tonnes of the material was tested which represented a total of 586 lots.
8. Overall, 94.9% of the material placed was accepted at full price and 5.1% of the material was accepted at an adjusted price. A total of 4 lots (11 kilotonnes) of Granular A were rejected.
9. Granular 0 had the most quality-related issues, with 40% of the lots tested receiving payment adjustments, while less than 20% of the lots tested from each of the three types of Granular B (Types I, II, and II) and Granular A received payment adjustments.
10. Payment adjustments amounted to approximately $321,500 in 2010.

# 6.0 - Acknowledgements

The Soils and Aggregates Section would like to acknowledge the Soils and Aggregates Quality Assurance Officers in each of the five Regional Quality Assurance Sections, who assembled and provided the QA Granular Summary Sheets and most of the other data that was used for these analyses. We would also like to acknowledge Ms. Katherine Hikita for reviewing the data and helping with the final assembly of this report.

**Table 4: Weighted Average Payment Adjustment Factors of Granular Materials Based on Lot Quantities Tested in 2010**

| | Granular O | | | Granular A | | | Granular BI | | | Granular BII | | | Granular BIII | | | Granular M | | | SSM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sieve (mm) | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total |
| 150 | | | | | | | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 |
| 106 0 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | | | | | | | |
| 37 5 | 0 00 | 0 00 | 0 00 | | | | | | | | | | | | | | | | | | |
| 26 5 | 0 00 | 0 00 | 0 00 | 0 02 | 0 00 | 0 02 | 0 00 | 0 00 | 0 00 | 0 00 | 0 16 | 0 16 | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 |
| 19 0 | 0 00 | 0 10 | 0 10 | 0 01 | 0 03 | 0 04 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | |
| 13 2 | 0 06 | 0 30 | 0 36 | 0 03 | 0 01 | 0 03 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | |
| 9 5 | 0 52 | 0 53 | 1 05 | 0 05 | 0 05 | 0 10 | | | | | | | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | | | |
| 4 75 | 0 00 | 0 00 | 0 00 | 0 62 | 0 07 | 0 69 | 0 00 | 0 00 | 0 00 | 0 03 | 0 02 | 0 05 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 1 18 | 0 00 | 0 00 | 0 00 | 0 10 | 0 01 | 0 11 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 0 3 | | | | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 0 15 | | | | | | | | | | | | | | | | | | | 0 00 | 0 00 | 0 00 |
| 0 075 | 0 00 | 0 00 | 0 00 | 0 03 | 0 00 | 0 03 | 0 20 | 0 05 | 0 25 | 0 10 | 0 00 | 0 10 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 15 | 0 15 |
| Total | 0 58 | 0 93 | 1 51 | 0 86 | 0 17 | 1 03 | 0 20 | 0 05 | 0 25 | 0 13 | 0 18 | 0 31 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 15 | 0 15 |

**Table 5: Weighted Average Payment Adjustment Factors of Granular Materials Based on Quantities Placed in 2010**

| | Granular O | | | Granular A | | | Granular BI | | | Granular BII | | | Granular BIII | | | Granular M | | | SSM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sieve (mm) | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total |
| 150 | | | | | | | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 |
| 106 0 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | | | | | | | |
| 37 5 | 0 00 | 0 00 | 0 00 | | | | | | | | | | | | | | | | | | |
| 26 5 | 0 00 | 0 00 | 0 00 | 0 01 | 0 00 | 0 01 | 0 00 | 0 00 | 0 00 | 0 00 | 0 05 | 0 05 | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 |
| 19 0 | 0 00 | 0 05 | 0 05 | 0 01 | 0 02 | 0 02 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | |
| 13 2 | 0 03 | 0 14 | 0 17 | 0 01 | 0 00 | 0 02 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | |
| 9 5 | 0 25 | 0 25 | 0 50 | 0 03 | 0 03 | 0 06 | | | | | | | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | | | |
| 4 75 | 0 00 | 0 00 | 0 00 | 0 35 | 0 04 | 0 39 | 0 00 | 0 00 | 0 00 | 0 01 | 0 01 | 0 02 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 1 18 | 0 00 | 0 00 | 0 00 | 0 06 | 0 01 | 0 06 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 0 3 | | | | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 0 15 | | | | | | | | | | | | | | | | | | | 0 00 | 0 00 | 0 00 |
| 0 075 | 0 00 | 0 00 | 0 00 | 0 02 | 0 00 | 0 02 | 0 09 | 0 02 | 0 12 | 0 03 | 0 00 | 0 03 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 03 | 0 03 |
| Total | 0 28 | 0 44 | 0 72 | 0 48 | 0 10 | 0 58 | 0 09 | 0 02 | 0 12 | 0 04 | 0 06 | 0 11 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 03 | 0 03 |

**Table 6: Weighted Average Payment Reduction of Granular Materials Based on Lot Quantities Tested in 2010 (¢/tonne)**

| | Granular O | | | Granular A | | | Granular BI | | | Granular BII | | | Granular BIII | | | Granular M | | | SSM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sieve (mm) | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total |
| 150 | | | | | | | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 |
| 106 0 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | | | | | | | |
| 37 5 | 0 00 | 0 00 | 0 00 | | | | | | | | | | | | | | | | | | |
| 26 5 | 0 00 | 0 00 | 0 00 | 0 25 | 0 03 | 0 28 | 0 00 | 0 00 | 0 00 | 0 00 | 1 87 | 1 87 | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 |
| 19 0 | 0 00 | 1 44 | 1 44 | 0 13 | 0 39 | 0 52 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | |
| 13 2 | 0 84 | 4 16 | 5 00 | 0 36 | 0 09 | 0 45 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | |
| 9 5 | 7 28 | 7 36 | 14 64 | 0 70 | 0 76 | 1 46 | | | | | | | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | | | |
| 4 75 | 0 00 | 0 00 | 0 00 | 8 69 | 1 00 | 9 69 | 0 00 | 0 00 | 0 00 | 0 38 | 0 28 | 0 66 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 1 18 | 0 00 | 0 00 | 0 00 | 1 43 | 0 14 | 1 57 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 0 3 | | | | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 0 15 | | | | | | | | | | | | | | | | | | | 0 00 | 0 00 | 0 00 |
| 0 075 | 0 00 | 0 00 | 0 00 | 0 42 | 0 04 | 0 45 | 2 02 | 0 47 | 2 50 | 1 21 | 0 00 | 1 21 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 1 18 |
| Total | 8 12 | 12 96 | 21 08 | 11 98 | 2 44 | 14 42 | 2 02 | 0 47 | 2 50 | 1 59 | 2 15 | 3 74 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 1 18 |

**Table 7: Weighted Average Payment Reduction of Granular Materials Based on Total Quantities Placed in 2010 (¢/tonne)**

| | Granular O | | | Granular A | | | Granular BI | | | Granular BII | | | Granular BIII | | | Granular M | | | SSM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sieve (mm) | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total | Mean | Range | Total |
| 150 | | | | | | | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 |
| 106 0 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | | | | | | | |
| 37 5 | 0 00 | 0 00 | 0 00 | | | | | | | | | | | | | | | | | | |
| 26 5 | 0 00 | 0 00 | 0 00 | 0 14 | 0 02 | 0 16 | 0 00 | 0 00 | 0 00 | 0 00 | 0 63 | 0 63 | 0 00 | 0 00 | 0 00 | | | | 0 00 | 0 00 | 0 00 |
| 19 0 | 0 00 | 0 69 | 0 69 | 0 07 | 0 22 | 0 29 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | |
| 13 2 | 0 40 | 1 99 | 2 39 | 0 20 | 0 05 | 0 25 | | | | | | | | | | 0 00 | 0 00 | 0 00 | | | |
| 9 5 | 3 48 | 3 52 | 6 99 | 0 39 | 0 42 | 0 82 | | | | | | | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | | | |
| 4 75 | 0 00 | 0 00 | 0 00 | 4 87 | 0 56 | 5 42 | 0 00 | 0 00 | 0 00 | 0 13 | 0 09 | 0 22 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 1 18 | 0 00 | 0 00 | 0 00 | 0 80 | 0 06 | 0 86 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 0 3 | | | | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 0 15 | | | | | | | | | | | | | | | | | | | 0 00 | 0 00 | 0 00 |
| 0 075 | 0 00 | 0 00 | 0 00 | 0 23 | 0 02 | 0 25 | 0 94 | 0 22 | 1 15 | 0 41 | 0 00 | 0 41 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 20 |
| Total | 3 88 | 6 19 | 10 07 | 6 71 | 1 37 | 8 07 | 0 94 | 0 22 | 1 15 | 0 54 | 0 73 | 1 26 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 20 |

# 7.0 - Reference

MTO "Aggregates for Granular O, A, B, M and Select Subgrade Materials", Special Provision No. 110S13, Ministry of Transportation, August 2007.
MTO "Aggregates for Granular O, A, B, M and Select Subgrade Materials", Special Provision No. 110S13, Ministry of Transportation, May 2010.

# 8.0 - Appendix A: Sources of Granular Aggregates Used by Each MTO Region During 2010

## Granular A

| Source | Kilotonnes | | | | | |
|---|---|---|---|---|---|---|
| | Region | | | | | Provincial Totals |
| | C | W | E | NE | NW | |
| Commercial Source | 237 | 436 | 162 | 1025 | 133 | 1993 |
| Non-Commercial Source | 41 | 0 | 0 | 579 | 411 | 1031 |
| Material from Right of Way | 0 | 8 | 0 | 110 | 0 | 118 |
| Total Natural Aggregate | 278 | 444 | 162 | 1714 | 544 | 3141 |
| RAP | 4.5 | 44.7 | 0.0 | 44.4 | 20.4 | 114.0 |
| RCM | 10.9 | 0.0 | 0.0 | 0.0 | 0.0 | 10.9 |
| Glass/Ceramics | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other Recycled/Reclaimed Material | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Recycled/Reclaimed Materials | 15.5 | 44.7 | 0.0 | 44.4 | 20.4 | 124.9 |

## Granular BI

| Source | Kilotonnes | | | | | |
|---|---|---|---|---|---|---|
| | Region | | | | | Provincial Totals |
| | C | W | E | NE | NW | |
| Commercial Source | 275 | 4 | 0 | 1166 | 0 | 1445 |
| Non-Commercial Source | 0 | 0 | 0 | 92 | 0 | 92 |
| Material from Right of Way | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Natural Aggregate | 275 | 4 | 0 | 1259 | 0 | 1538 |
| RAP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RCM | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Glass/Ceramics | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other Recycled/Reclaimed Material | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Recycled/Reclaimed Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

## Granular BII

| Source | Kilotonnes | | | | | |
|---|---|---|---|---|---|---|
| | Region | | | | | Provincial Totals |
| | C | W | E | NE | NW | |
| Commercial Source | 25 | 24 | 503 | 309 | 14 | 876 |
| Non-Commercial Source | 0 | 0 | 0 | 56 | 27 | 82 |
| Material from Right of Way | 0 | 0 | 0 | 554 | 0 | 554 |
| Total Natural Aggregate | 25 | 24 | 503 | 919 | 41 | 1513 |
| RAP | N/A | N/A | N/A | N/A | N/A | N/A |
| RCM | N/A | N/A | N/A | N/A | N/A | N/A |
| Glass/Ceramics | N/A | N/A | N/A | N/A | N/A | N/A |
| Other Recycled/Reclaimed Material | N/A | N/A | N/A | N/A | N/A | N/A |
| Total Recycled/Reclaimed Materials | N/A | N/A | N/A | N/A | N/A | N/A |

## Granular BIII

| Source | Kilotonnes | | | | | |
|---|---|---|---|---|---|---|
| | Region | | | | | Provincial Totals |
| | C | W | E | NE | NW | |
| Commercial Source | 0 | 231 | 4 | 32 | 46 | 313 |
| Non-Commercial Source | 0 | 0 | 0 | 0 | 38 | 38 |
| Material from Right of Way | 0 | 57 | 0 | 292 | 0 | 349 |
| Total Natural Aggregate | 0 | 288 | 4 | 323 | 85 | 700 |
| RAP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RCM | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Glass/Ceramics | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other Recycled Material | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Recycled Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

## Granular O

| Source | Kilotonnes | | | | | |
|---|---|---|---|---|---|---|
| | Region | | | | | Provincial Totals |
| | C | W | E | NE | NW | |
| Commercial Source | 0 | 0 | 183 | 0 | 0 | 183 |
| Non-Commercial Source | 0 | 0 | 0 | 0 | 0 | 0 |
| Material from Right of Way | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Natural Aggregate | 0 | 0 | 183 | 0 | 0 | 183 |
| RAP | N/A | N/A | N/A | N/A | N/A | N/A |
| RCM | N/A | N/A | N/A | N/A | N/A | N/A |
| Glass/Ceramics | N/A | N/A | N/A | N/A | N/A | N/A |
| Other Recycled/Reclaimed Material | N/A | N/A | N/A | N/A | N/A | N/A |
| Total Recycled/Reclaimed Materials | N/A | N/A | N/A | N/A | N/A | N/A |

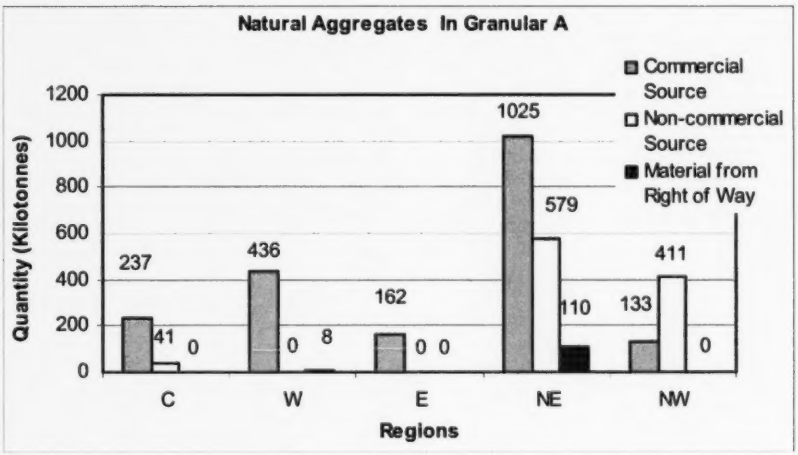
## Granular M

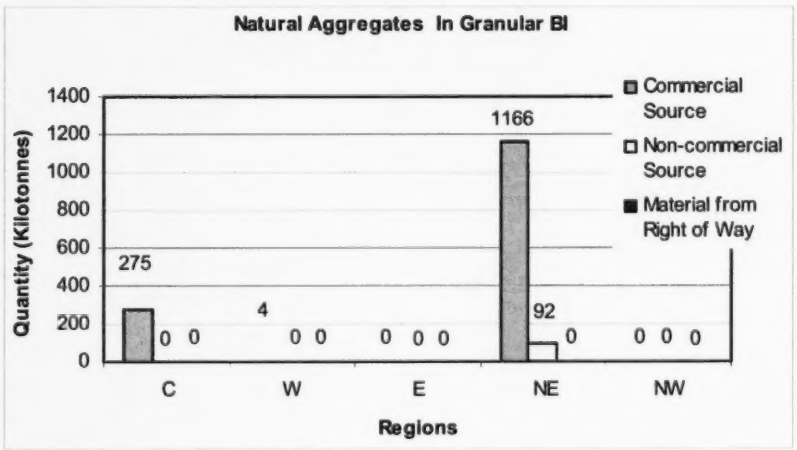
| Source | Kilotonnes | | | | | |
|---|---|---|---|---|---|---|
| | Region | | | | | Provincial Totals |
| | C | W | E | NE | NW | |
| Commercial Source | 0 | 0 | 0 | 12 | 0 | 12 |
| Non-Commercial Source | 0 | 0 | 0 | 0 | 0 | 0 |
| Material from Right of Way | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Natural Aggregate | 0 | 0 | 0 | 12 | 0 | 12 |
| RAP | N/A | N/A | N/A | N/A | N/A | N/A |
| RCM | N/A | N/A | N/A | N/A | N/A | N/A |
| Glass/Ceramics | N/A | N/A | N/A | N/A | N/A | N/A |
| Other Recycled/Reclaimed Material | N/A | N/A | N/A | N/A | N/A | N/A |
| Total Recycled/Reclaimed Materials | N/A | N/A | N/A | N/A | N/A | N/A |

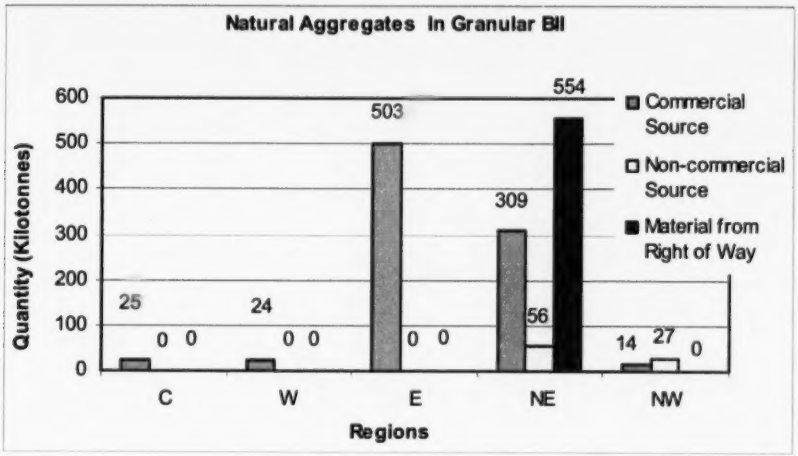
## SSM

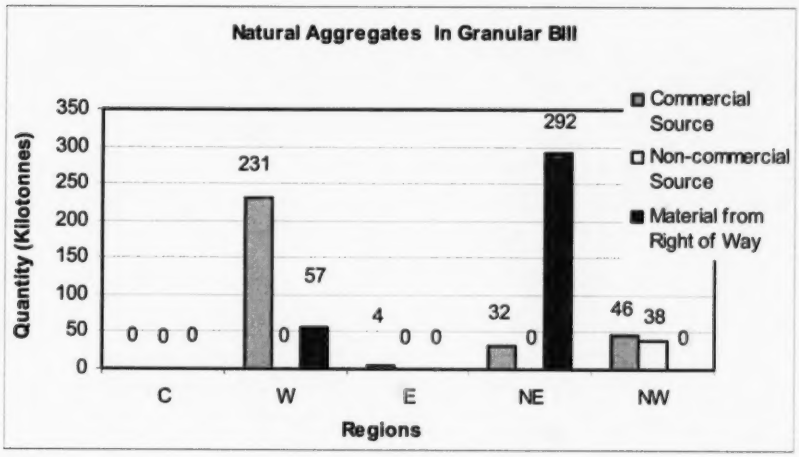
| Source | Kilotonnes | | | | | |
|---|---|---|---|---|---|---|
| | Region | | | | | Provincial Totals |
| | C | W | E | NE | NW | |
| Commercial Source | 0 | 0 | 474 | 679 | 0 | 1153 |
| Non-Commercial Source | 0 | 0 | 0 | 0 | 0 | 0 |
| Material from Right of Way | 0 | 0 | 85 | 0 | 0 | 85 |
| Total Natural Aggregate | 0 | 0 | 559 | 679 | 0 | 1238 |
| RAP | N/A | N/A | N/A | N/A | N/A | N/A |
| RCM | N/A | N/A | N/A | N/A | N/A | N/A |
| Glass/Ceramics | N/A | N/A | N/A | N/A | N/A | N/A |
| Other Recycled/Reclaimed Material | N/A | N/A | N/A | N/A | N/A | N/A |
| Total Recycled/Reclaimed Materials | N/A | N/A | N/A | N/A | N/A | N/A |

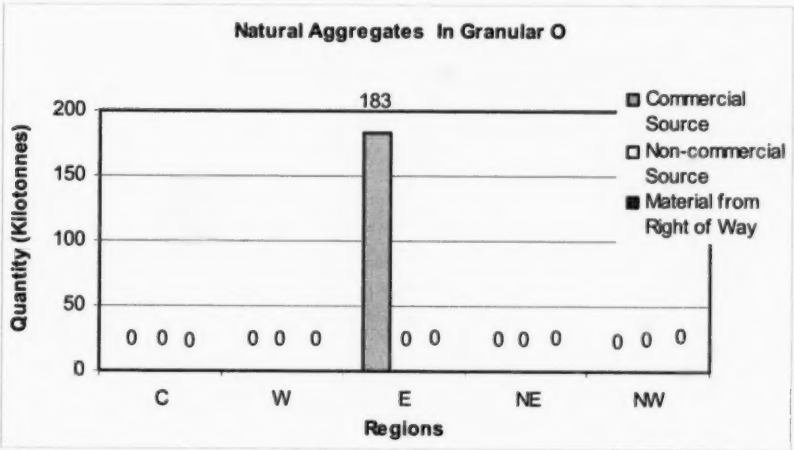
# 9.0 - Appendix B: Quantities of Natural Aggregates by Source Used in Granular Aggregates by Each MTO Region in 2010

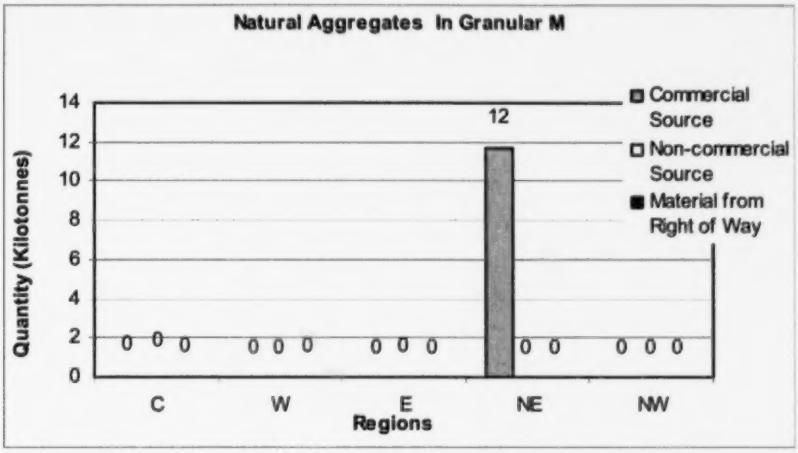


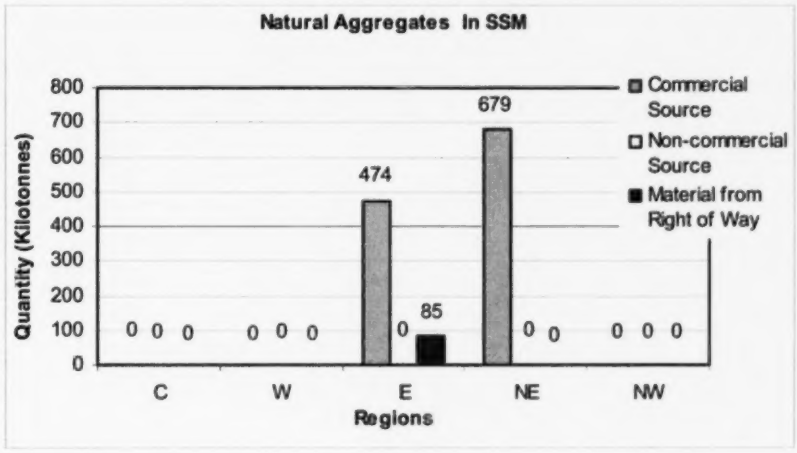




Natural Aggregates In Granular BII
Quantity (Kilotonnes)
600
500
400
300
200
100
0
25
0 0
24
0 0
503
0 0
309
554
56
14
27
0
C
W
E
NE
NW
Regions
Commercial Source
Non-commercial Source
Material from Right of Way


Natural Aggregates In Granular BIII
Quantity (Kilotonnes)
350
300
250
200
150
100
50
0
0 0 0
231
0
57
4
0 0
32
292
0
46
38
0
C
W
E
NE
NW
Regions
Commercial Source
Non-commercial Source
Material from Right of Way

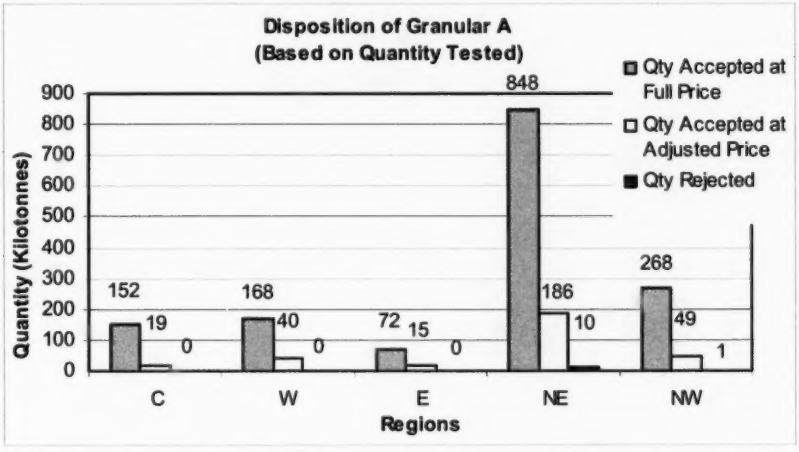

Natural Aggregates In Granular O
Quantity (Kilotonnes)
200
150
100
50
0
0 0 0
0 0 0
183
0 0
0 0 0
0 0 0
C
W
E
NE
NW
Regions
Commercial Source
Non-commercial Source
Material from Right of Way

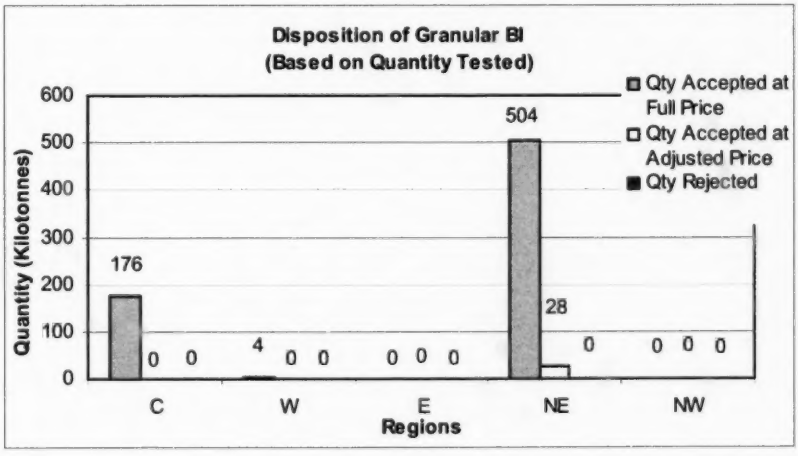

Natural Aggregates In Granular M
Quantity (Kilotonnes)
14
12
10
8
6
4
2
0
12
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
C
W
E
NE
NW
Regions
Commercial Source
Non-commercial Source
Material from Right of Way

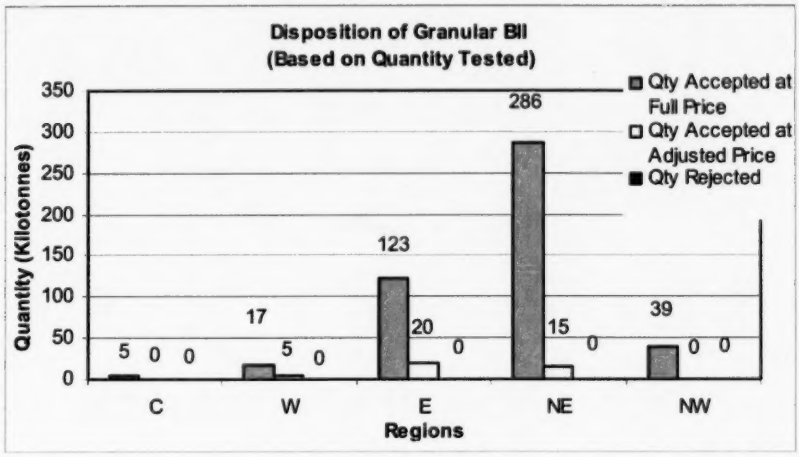

Natural Aggregates In SSM
Quantity (Kilotonnes)
800
700
600
500
400
300
200
100
0
679
474
85
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
C
W
E
NE
NW
Regions
Commercial Source
Non-commercial Source
Material from Right of Way

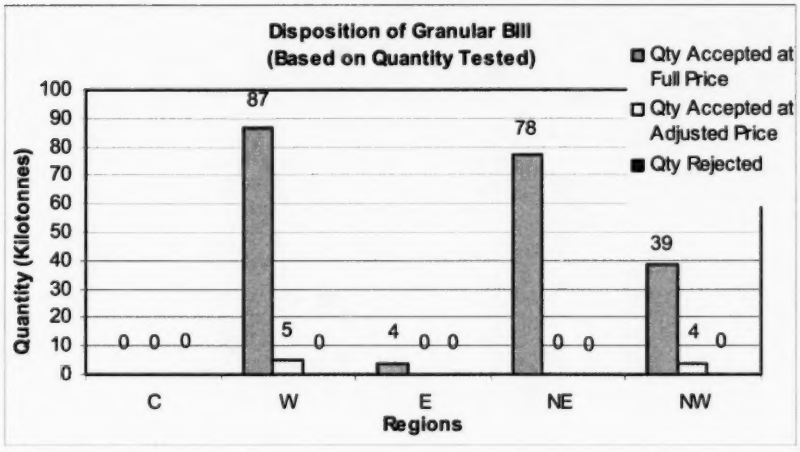
# 10.0 - Appendix C: Disposition of QA Lots of Granular Aggregates Tested in Each MTO Region in 2010

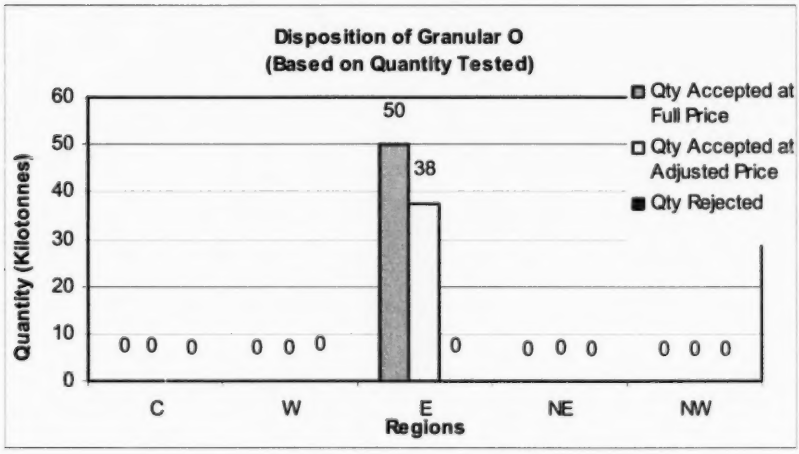
## 10.1 - DISPOSITION BASED ON QUANTITIES WITHIN THE LOTS TESTED

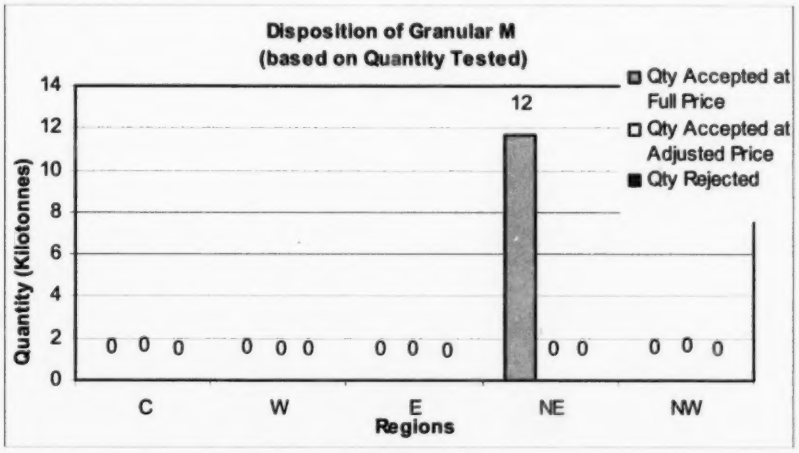


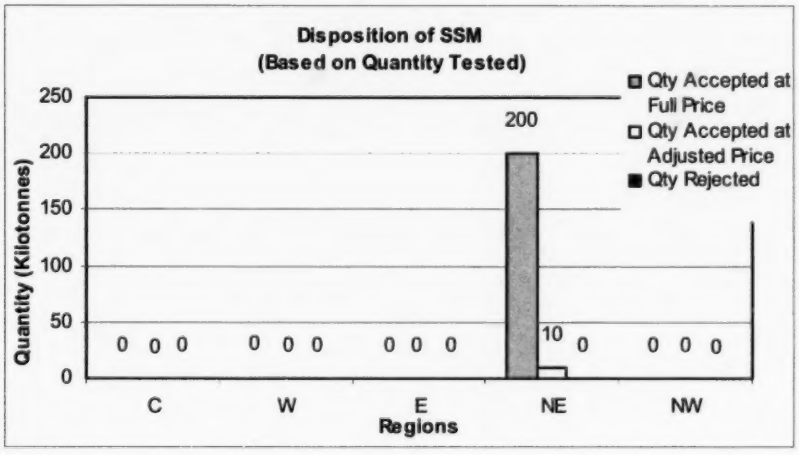




Disposition of Granular BII
(Based on Quantity Tested)
Quantity (Kilotonnes)
350
300
250
200
150
100
50
0
5 0 0
17
5 0
123
20 0
286
15 0
39
0 0
C
W
E
NE
NW
Regions
Qty Accepted at Full Price
Qty Accepted at Adjusted Price
Qty Rejected

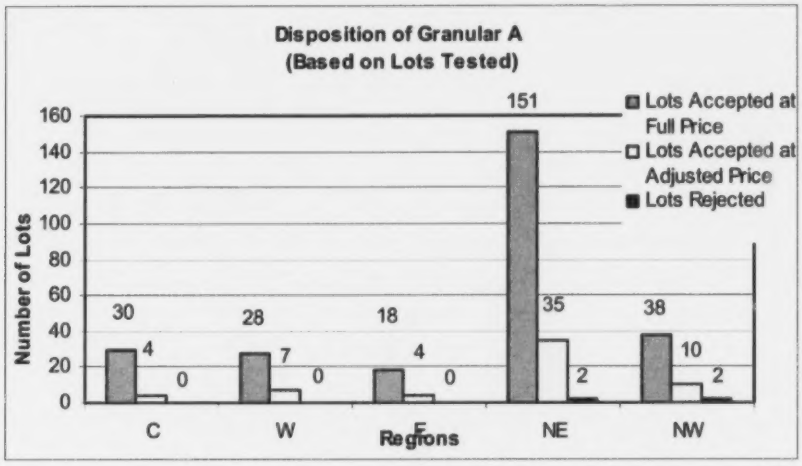

Disposition of Granular BIII
(Based on Quantity Tested)
Quantity (Kilotonnes)
100
90
80
70
60
50
40
30
20
10
0
0 0 0
87
5 0
4 0 0
78
0 0
39
4 0
C
W
E
NE
NW
Regions
Qty Accepted at Full Price
Qty Accepted at Adjusted Price
Qty Rejected

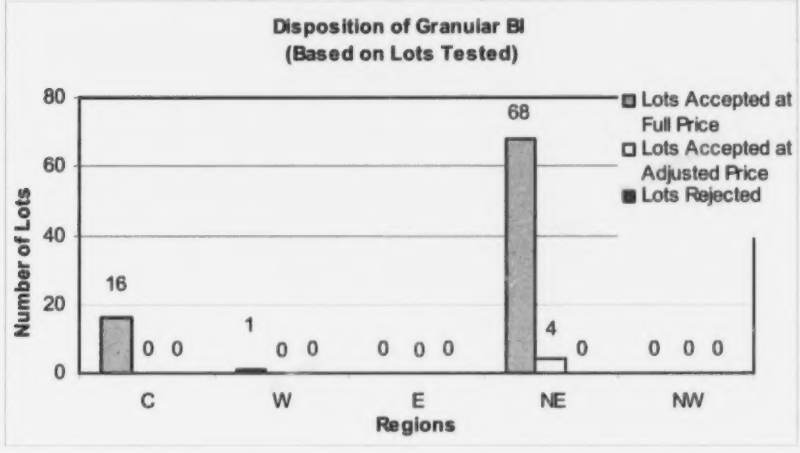

Disposition of Granular O
(Based on Quantity Tested)
Quantity (Kilotonnes)
60
50
40
30
20
10
0
0 0 0
0 0 0
50
38
0
0 0 0
0 0 0
C
W
E
NE
NW
Regions
Qty Accepted at Full Price
Qty Accepted at Adjusted Price
Qty Rejected

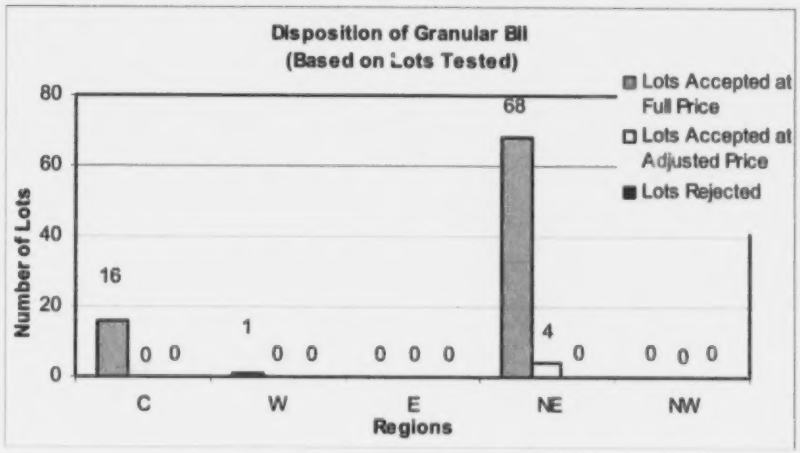

Disposition of Granular M
(based on Quantity Tested)
Quantity (Kilotonnes)
14
12
10
8
6
4
2
0
12
0 0 0 0 0 0 0 0 0 0 0 0 0
C
W
E
NE
NW
Regions
Qty Accepted at Full Price
Qty Accepted at Adjusted Price
Qty Rejected

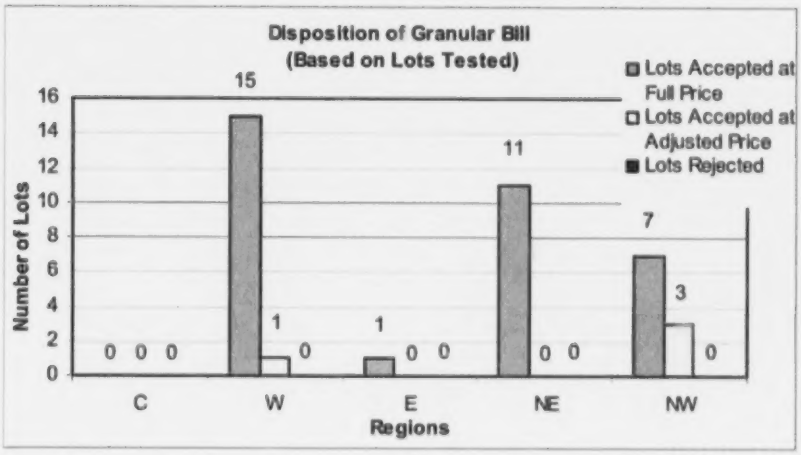

Disposition of SSM
(Based on Quantity Tested)
Quantity (Kilotonnes)
250
200
150
100
50
0
200
10
0 0 0 0 0 0 0 0 0 0 0 0 0
C
W
E
NE
NW
Regions
Qty Accepted at Full Price
Qty Accepted at Adjusted Price
Qty Rejected

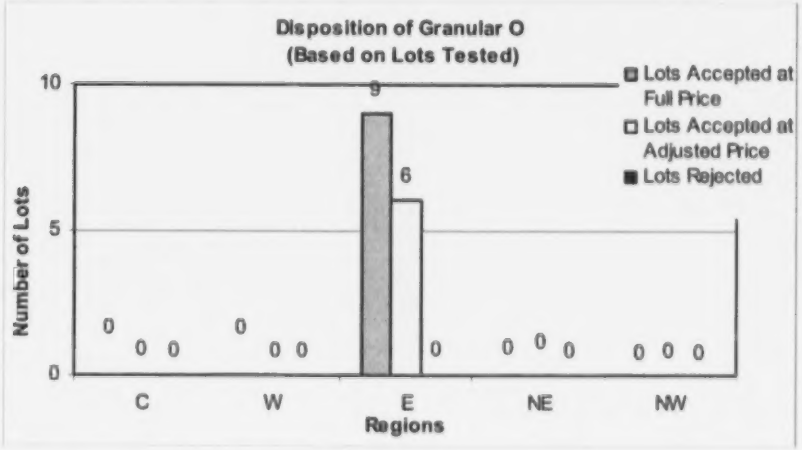
# 10.2 - DISPOSITION BASED ON NUMBER OF LOTS TESTED

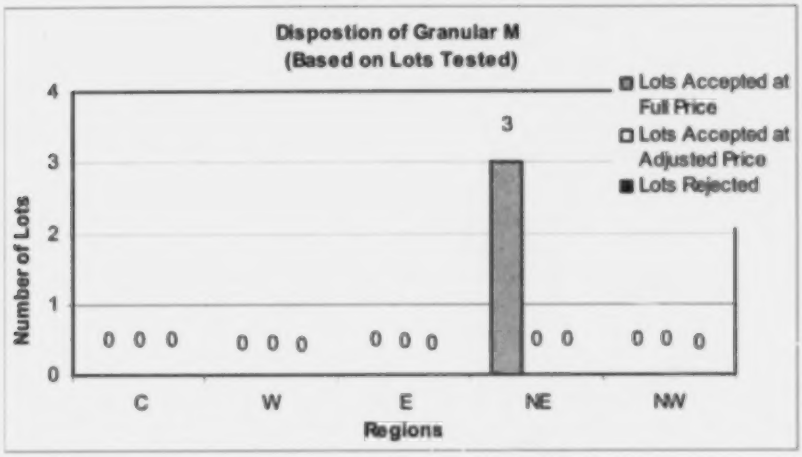


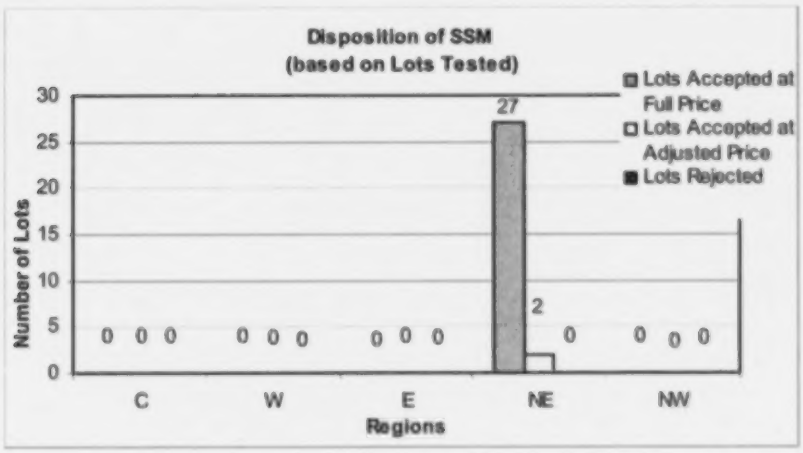




Disposition of Granular BII
(Based on Lots Tested)
Number of Lots
80
60
40
20
0
16
0 0
1
0 0
0 0 0
68
4
0
0 0 0
C
W
E
NE
NW
Regions
Lots Accepted at Full Price
Lots Accepted at Adjusted Price
Lots Rejected


Disposition of Granular BIII
(Based on Lots Tested)
Number of Lots
16
14
12
10
8
6
4
2
0
0 0 0
15
1
0
1
0 0
11
0 0
7
3
0
C
W
E
NE
NW
Regions
Lots Accepted at Full Price
Lots Accepted at Adjusted Price
Lots Rejected


Disposition of Granular O
(Based on Lots Tested)
Number of Lots
10
5
0
0
0 0
0
0 0
9
6
0
0 0 0
0 0 0
C
W
E
NE
NW
Regions
Lots Accepted at Full Price
Lots Accepted at Adjusted Price
Lots Rejected


Dispostion of Granular M
(Based on Lots Tested)
Lots Accepted at Full Price
Lots Accepted at Adjusted Price
Lots Rejected
Number of Lots
0
1
2
3
4
0 0 0
0 0 0
0 0 0
3
0 0
0 0 0
C
W
E
NE
NW
Regions


Disposition of SSM
(based on Lots Tested)
Lots Accepted at Full Price
Lots Accepted at Adjusted Price
Lots Rejected
Number of Lots
0
5
10
15
20
25
30
0 0 0
0 0 0
0 0 0
27
2
0
0 0 0
C
W
E
NE
NW
Regions

# 11.0 - Appendix D: Lot Summary of Granular Aggregates Tested by Each Region in 2010

## Granular A

| Region | C | W | E | NE | NW | Provincial Totals |
|---|---|---|---|---|---|---|
| Lots Tested | 34 | 35 | 22 | 188 | 50 | 329 |
| Qty Tested (kt) | 171 | 208 | 87 | 1044 | 318 | 1829 |
| Lots Accepted at Full Price | 30 | 28 | 18 | 151 | 38 | 265 |
| Qty Accepted at Full Price (kt) | 152 | 168 | 72 | 848 | 268 | 1508 |
| Lots Accepted at Adjusted Price | 4 | 7 | 4 | 35 | 10 | 60 |
| Qty Accepted at Adjusted Price (kt) | 19 | 40 | 15 | 186 | 49 | 310 |
| Lots Rejected | 0 | 0 | 0 | 2 | 2 | 4 |
| Qty Rejected (kt) | 0 | 0 | 0 | 10 | 1 | 11 |

## Granular BI

| Region | C | W | E | NE | NW | Provincial Totals |
|---|---|---|---|---|---|---|
| Lots Tested | 16 | 1 | 0 | 72 | 0 | 89 |
| Qty Tested (kt) | 176 | 4 | 0 | 531 | 0 | 711 |
| Lots Accepted at Full Price | 16 | 1 | 0 | 68 | 0 | 85 |
| Qty Accepted at Full Price (kt) | 176 | 4 | 0 | 504 | 0 | 684 |
| Lots Accepted at Adjusted Price | 0 | 0 | 0 | 4 | 0 | 4 |
| Qty Accepted at Adjusted Price (kt) | 0 | 0 | 0 | 28 | 0 | 28 |
| Lots Rejected | 0 | 0 | 0 | 0 | 0 | 0 |
| Qty Rejected (kt) | 0 | 0 | 0 | 0 | 0 | 0 |

## Granular BII

| Region | C | W | E | NE | NW | Provincial Totals |
|---|---|---|---|---|---|---|
| Lots Tested | 2 | 5 | 18 | 50 | 8 | 83 |
| Qty Tested (kt) | 5 | 22 | 143 | 301 | 39 | 510 |
| Lots Accepted at Full Price | 2 | 4 | 15 | 49 | 8 | 78 |
| Qty Accepted at Full Price (kt) | 5 | 17 | 123 | 286 | 39 | 470 |
| Lots Accepted at Adjusted Price | 0 | 1 | 3 | 1 | 0 | 5 |
| Qty Accepted at Adjusted Price (kt) | 0 | 5 | 20 | 15 | 0 | 40 |
| Lots Rejected | 0 | 0 | 0 | 0 | 0 | 0 |
| Qty Rejected (kt) | 0 | 0 | 0 | 0 | 0 | 0 |

## Granular BIII

| Region | C | W | E | NE | NW | Provincial Totals |
|---|---|---|---|---|---|---|
| Lots Tested | 0 | 16 | 1 | 11 | 10 | 38 |
| Qty Tested (kt) | 0 | 92 | 4 | 78 | 43 | 216 |
| Lots Accepted at Full Price | 0 | 15 | 1 | 11 | 7 | 34 |
| Qty Accepted at Full Price (kt) | 0 | 87 | 4 | 78 | 39 | 207 |
| Lots Accepted at Adjusted Price | 0 | 1 | 0 | 0 | 3 | 4 |
| Qty Accepted at Adjusted Price (kt) | 0 | 5 | 0 | 0 | 4 | 9 |
| Lots Rejected | 0 | 0 | 0 | 0 | 0 | 0 |
| Qty Rejected (kt) | 0 | 0 | 0 | 0 | 0 | 0 |

## Granular O

| Region | C | W | E | NE | NW | Provincial Totals |
|---|---|---|---|---|---|---|
| Lots Tested | 0 | 0 | 15 | 0 | 0 | 15 |
| Qty Tested (kt) | 0 | 0 | 88 | 0 | 0 | 88 |
| Lots Accepted at Full Price | 0 | 0 | 9 | 0 | 0 | 9 |
| Qty Accepted at Full Price (kt) | 0 | 0 | 50 | 0 | 0 | 50 |
| Lots Accepted at Adjusted Price | 0 | 0 | 6 | 0 | 0 | 6 |
| Qty Accepted at Adjusted Price (kt) | 0 | 0 | 38 | 0 | 0 | 38 |
| Lots Rejected | 0 | 0 | 0 | 0 | 0 | 0 |
| Qty Rejected (kt) | 0 | 0 | 0 | 0 | 0 | 0 |

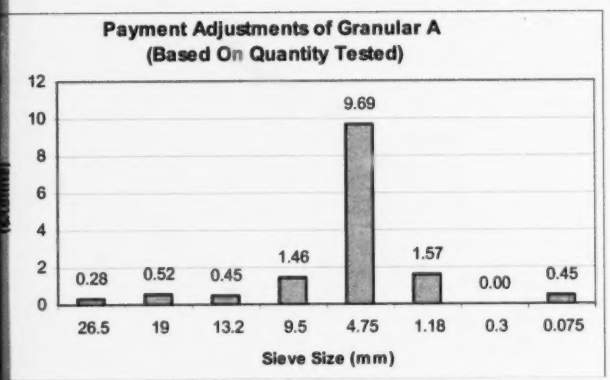
## Granular M

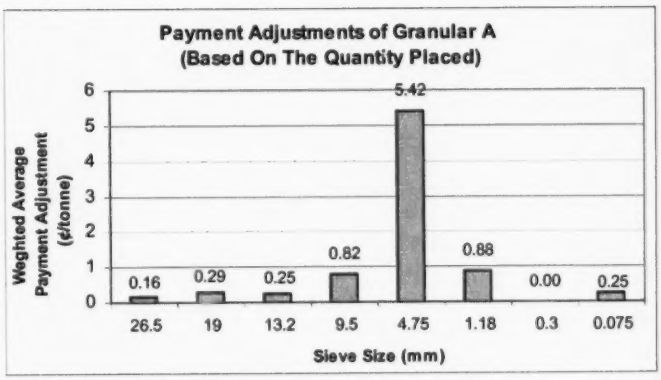
| Region | C | W | E | NE | NW | Provincial Totals |
|---|---|---|---|---|---|---|
| Lots Tested | 0 | 0 | 0 | 3 | 0 | 3 |
| Qty Tested (kt) | 0 | 0 | 0 | 12 | 0 | 12 |
| Lots Accepted at Full Price | 0 | 0 | 0 | 3 | 0 | 3 |
| Qty Accepted at Full Price (kt) | 0 | 0 | 0 | 12 | 0 | 12 |
| Lots Accepted at Adjusted Price | 0 | 0 | 0 | 0 | 0 | 0 |
| Qty Accepted at Adjusted Price (kt) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lots Rejected | 0 | 0 | 0 | 0 | 0 | 0 |
| Qty Rejected (kt) | 0 | 0 | 0 | 0 | 0 | 0 |

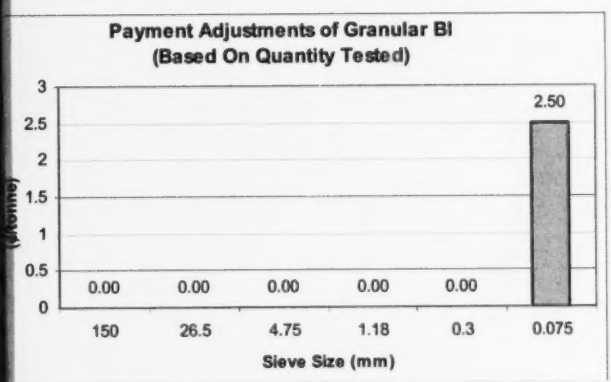
## SSM

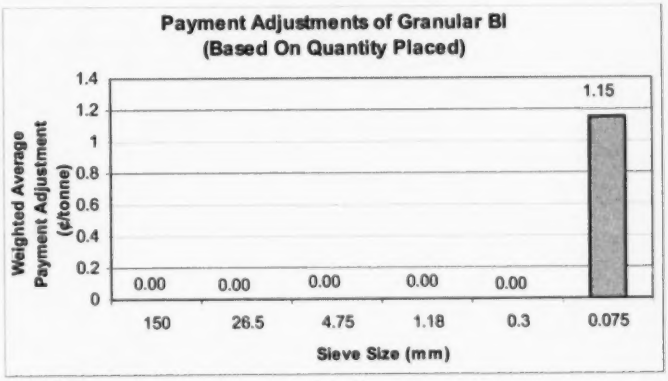
| Region | C | W | E | NE | NW | Provincial Totals |
|---|---|---|---|---|---|---|
| Lots Tested | 0 | 0 | 0 | 29 | 0 | 29 |
| Qty Tested (kt) | 0 | 0 | 0 | 210 | 0 | 210 |
| Lots Accepted at Full Price | 0 | 0 | 0 | 27 | 0 | 27 |
| Qty Accepted at Full Price (kt) | 0 | 0 | 0 | 200 | 0 | 200 |
| Lots Accepted at Adjusted Price | 0 | 0 | 0 | 2 | 0 | 2 |
| Qty Accepted at Adjusted Price (kt) | 0 | 0 | 0 | 10 | 0 | 10 |
| Lots Rejected | 0 | 0 | 0 | 0 | 0 | 0 |
| Qty Rejected (kt) | 0 | 0 | 0 | 0 | 0 | 0 |

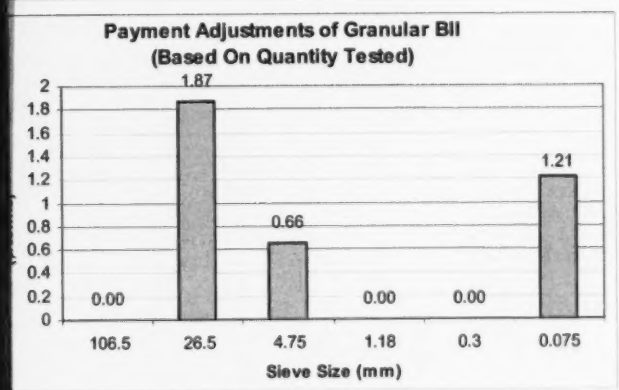
# 12.0 - Appendix E: Summary of Weighted Average Payment Adjustments for Quantities Tested and Quantities Placed in 2010 (¢/tonne)

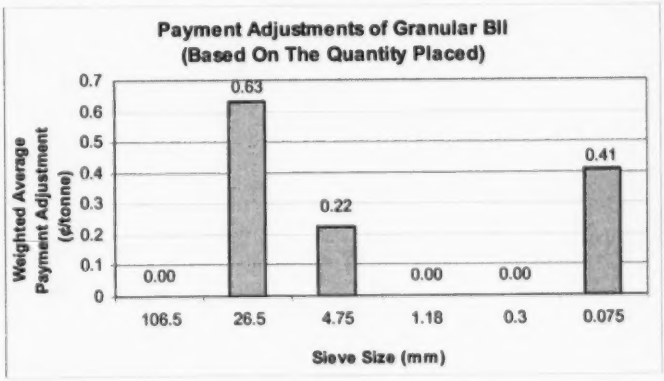


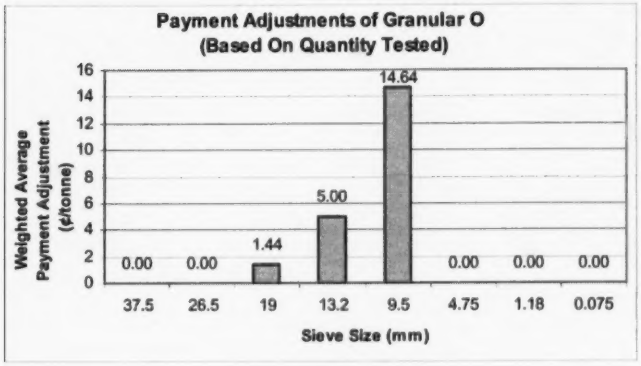



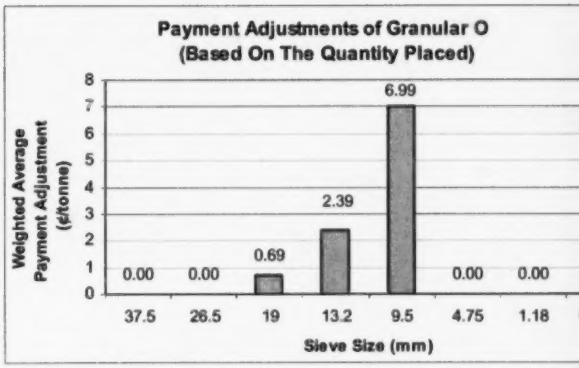



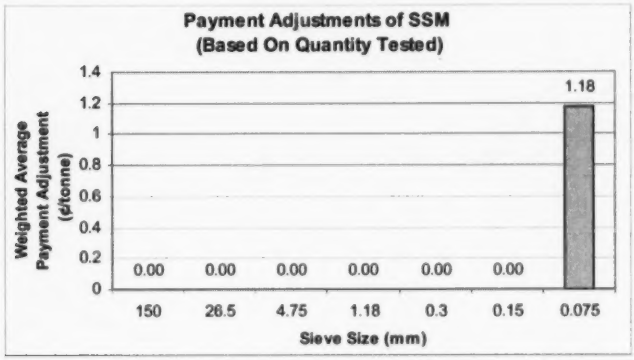




Payment Adjustments of Granular O
(Based On Quantity Tested)
Weighted Average Payment Adjustment (¢/tonne)
16
14
12
10
8
6
4
2
0
0.00
0.00
1.44
5.00
14.64
0.00
0.00
0.00
37.5
26.5
19
13.2
9.5
4.75
1.18
0.075
Sieve Size (mm)


Payment Adjustments of Granular O
(Based On The Quantity Placed)
Weighted Average Payment Adjustment (¢/tonne)
8
7
6
5
4
3
2
1
0
0.00
0.00
0.69
2.39
6.99
0.00
0.00
37.5
26.5
19
13.2
9.5
4.75
1.18
Sieve Size (mm)


Payment Adjustments of SSM
(Based On Quantity Tested)
Weighted Average Payment Adjustment (¢/tonne)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.00
0.00
0.00
0.00
0.00
0.00
1.18
150
26.5
4.75
1.18
0.3
0.15
0.075
Sieve Size (mm)

Payment Adjustments of SSM
(Based On The Quantity Placed)
Weighted Average Payment Adjustment (¢/tonne)
0.25
0.2
0.15
0.1
0.05
0
0.00
0.00
0.00
0.00
0.00
0.00
150
26.5
4.75
1.18
0.3
0.15
Sieve Size (mm)